No. 1961 Vol. XLVI AUGUST 24th, 1944

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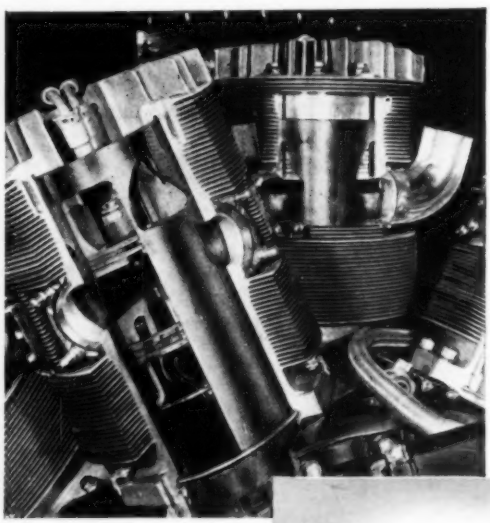

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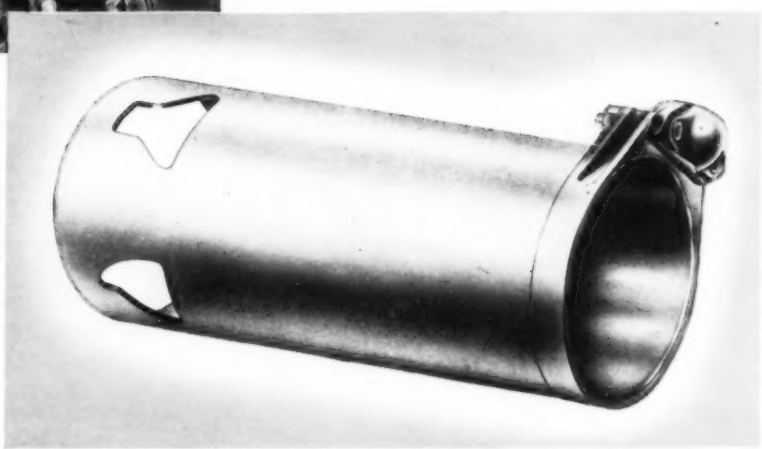
This is one of a series of twelve advertisements prepared for retention, and constitutes a simple story of sleeve-valve advantages. Previous copies are available on request to the Bristol Aeroplane Company Ltd., Bristol.



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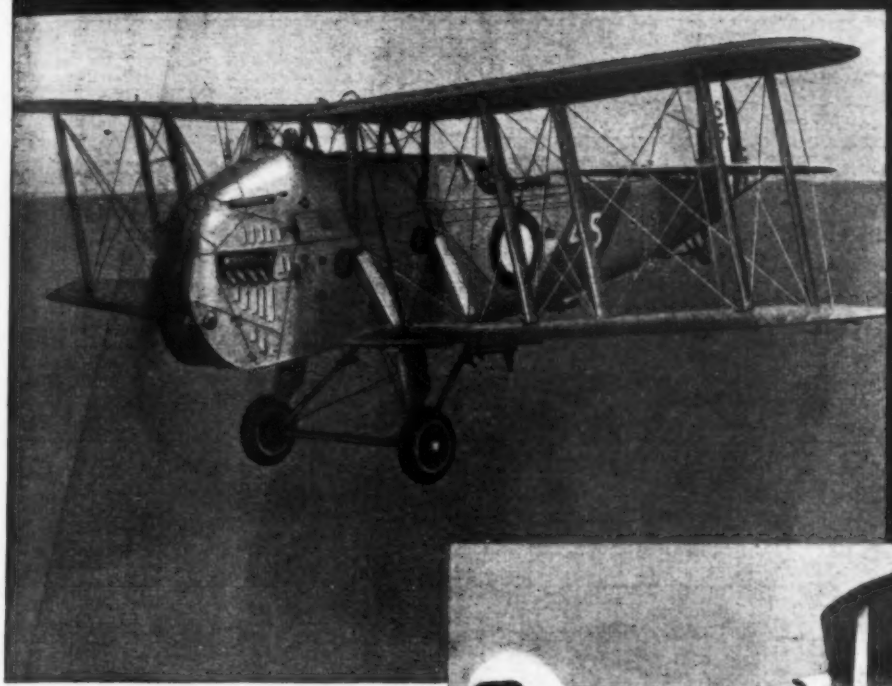

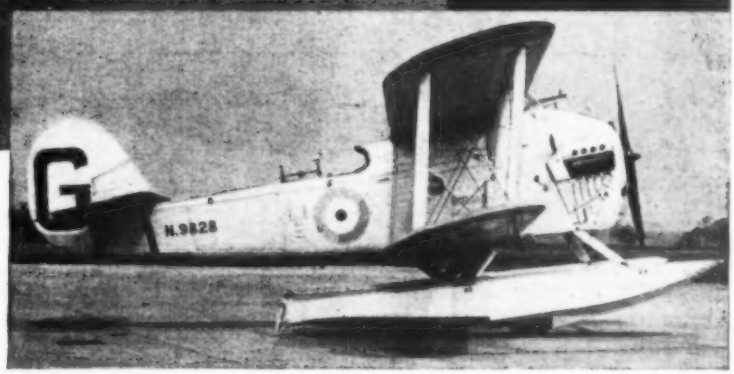

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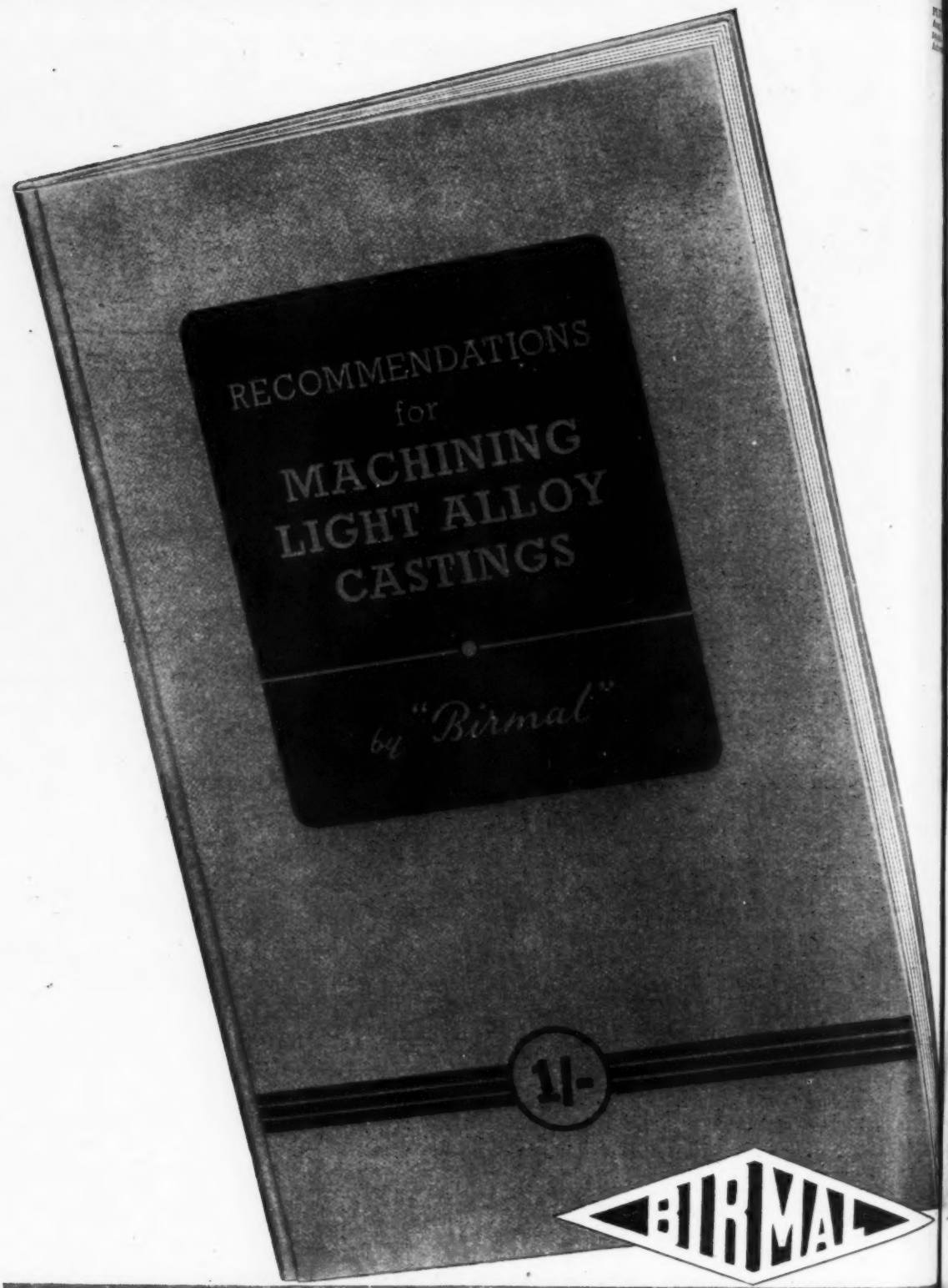

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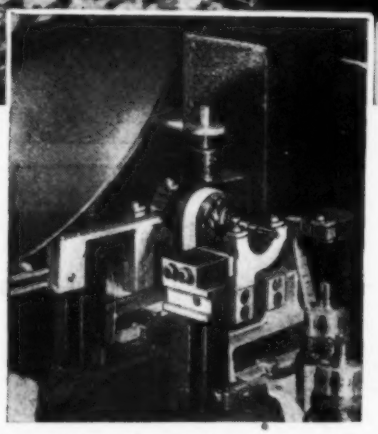

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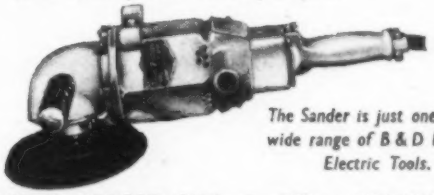

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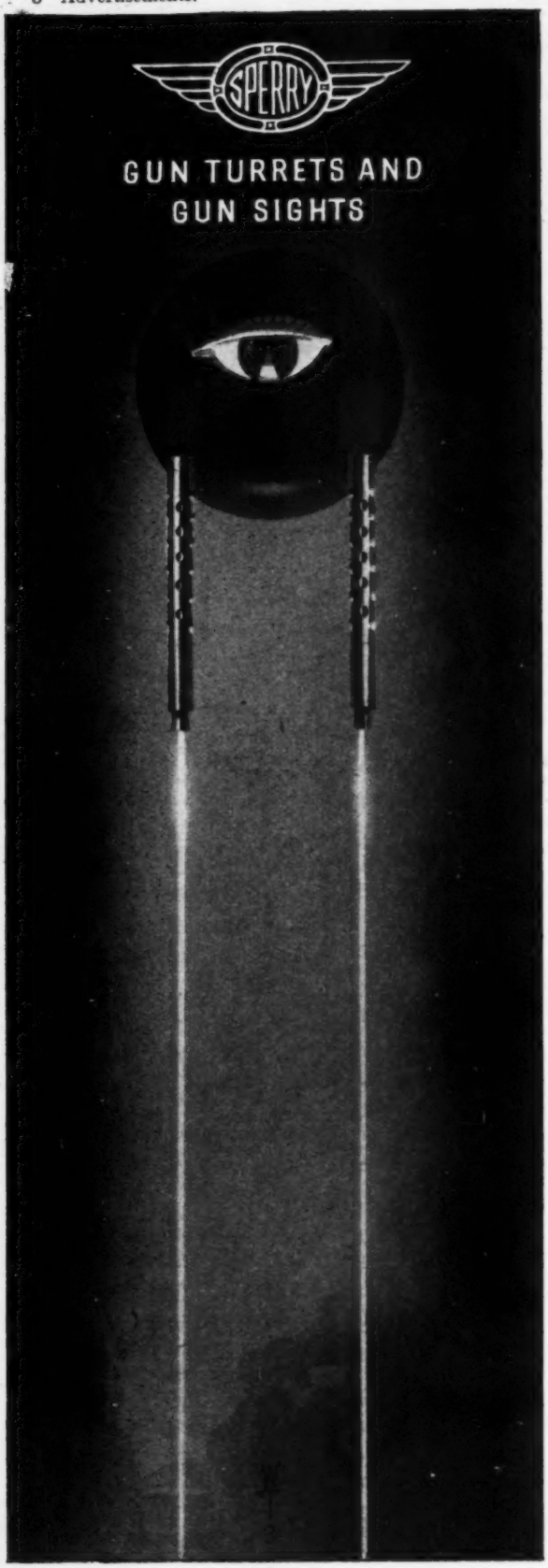

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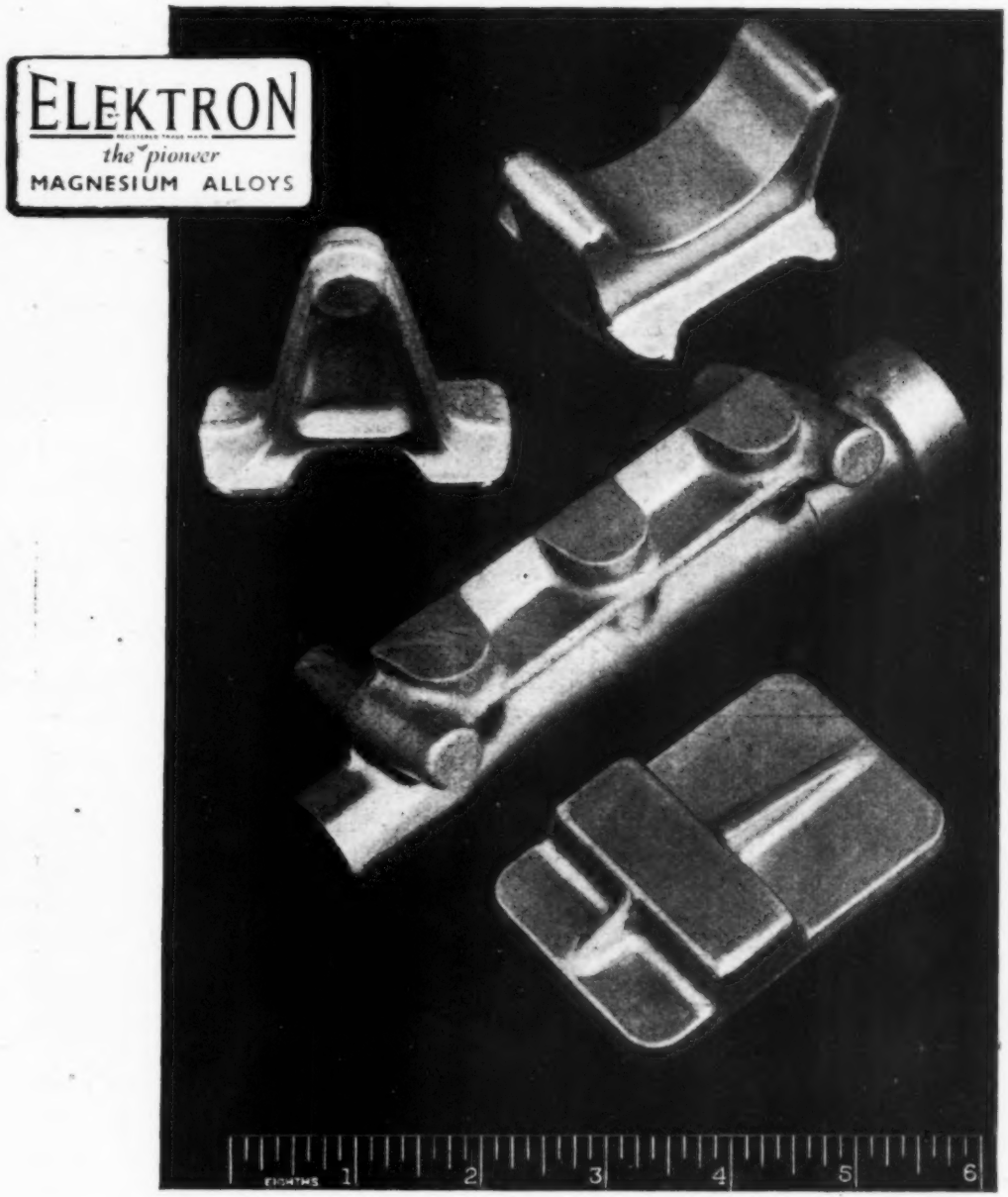

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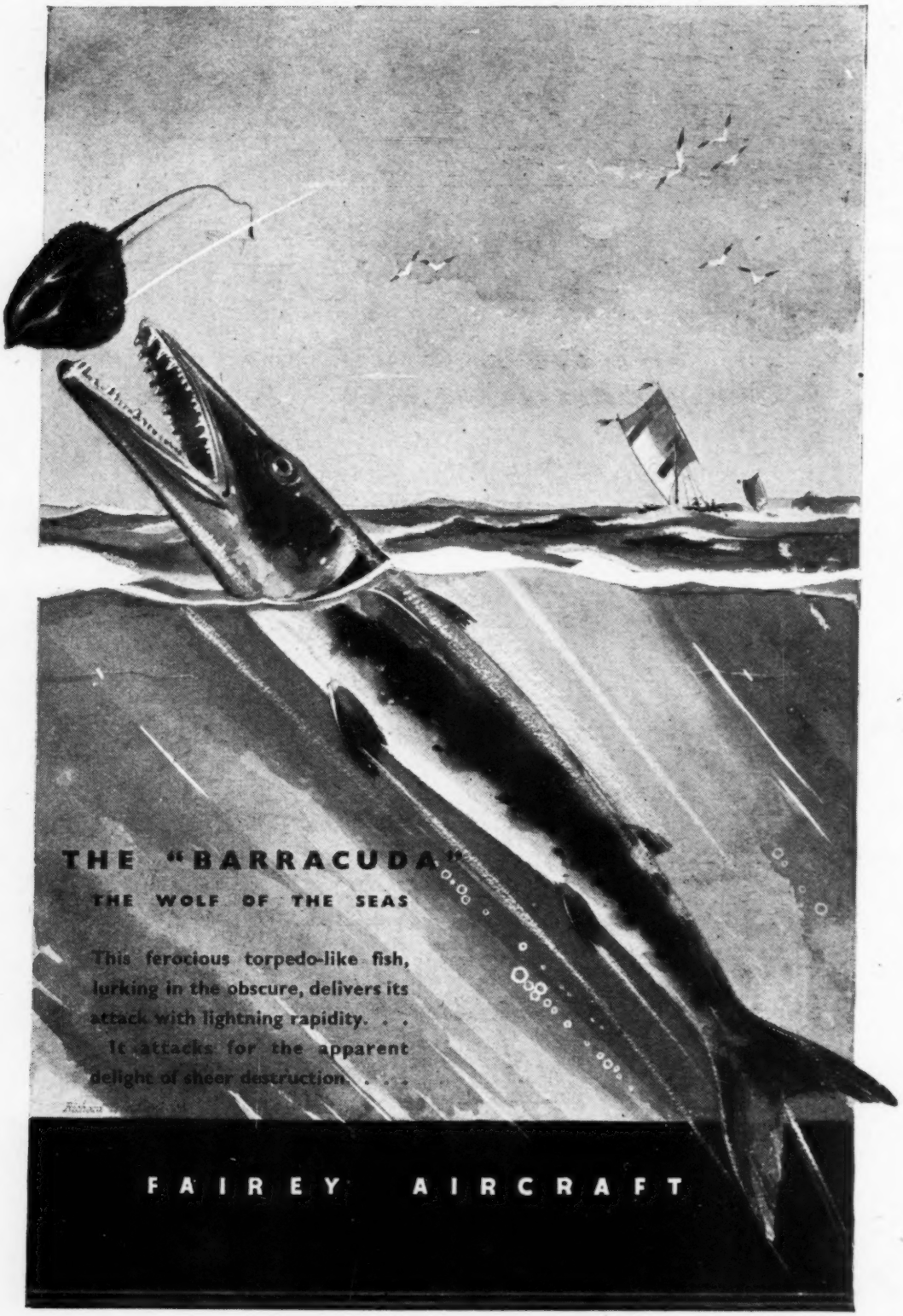
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FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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The Outlook

The Under-belly Again

GENERAL MAITLAND WILSON has taken some of us by surprise. That there would be an Allied landing on the south coast of France sooner or later was a safe guess for everyone; but there seemed good reason for thinking that it would not take place until General Alexander had broken through the Gothic Line in Italy and got astride the Grande Corniche road which runs along the coast through San Remo and Ventimiglia into France. The Supreme Commander in the Mediterranean has not waited for that to happen.

The preliminary concentration of bombing attentions on the communications along the south coast of France prepared the mind of everybody for a definite move in the near future. The German High Command must have sensed it, but, judging by the event, they found themselves in no position to take any measures to avert the blow. Had the *Luftwaffe* been but a respectable shadow of its former self, an air attack on the landing forces would surely have been made. But of air opposition there was literally none until the Allies were well ashore; and then the efforts of the German airmen were almost microscopic.

It is now a platitude to remark that an army unsupported by an efficient air component is (except in very hilly country) defeated before a single shot is fired. At the moment it looks as if the Allies have before them little but a trek (partly perhaps by train) up the Rhône valley into the heart of France.

One would like to know what Marshal Kesselring thinks about it all. He has only been fighting a holding and delaying battle in Italy, and he must always have had his eyes turned to possible bolt-holes when his situation became desperate. A withdrawal into France must surely have been one of the ideas in his mind. That bolt-hole has now been plugged. He could not count on escape for his whole force through the Brenner Pass, for it is narrow, and the railways leading up to it have been under air bombardment for a long time past.

There remains the road into Yugoslavia. The possibilities connected with that route have doubtless been carefully discussed by Mr. Churchill and Marshal Tito in their recent meeting in Italy. It is also significant that the formation of a special Balkan Air Force from the squadrons in the Mediterranean has recently been announced. There emerges a very distinct possibility that Kesselring's forces in northern Italy have now been caught in a trap, and have to face the prospect of complete elimination.

A Great Air Victory

NEVER, perhaps, has the value of air supremacy been more emphatically demonstrated than in the great sweep of American armour round from Brittany to the outskirts of Paris. It is all the more remarkable because practically no air combats or bombing attacks were included in the manœuvre. Air supremacy worked silently, as does the Navy, and produced the most astonishing and gratifying results.

Enthusiasts have told the world that air power smashed Poland and France, because the Stukas were prompt to attack any strong points which delayed the advance of the German tanks; that air power drove the British out of Norway; that air power made possible Auchinleck's retreat to Alamein; that air power cleared the way for the armies in Tunisia; in addition to giving yeoman help to the Allies in Sicily and Italy. But never has air power achieved greater results than when it conferred on the American armour absolute freedom to dash about France at its will. The Americans were not only free from bombing from above; they were practically unopposed on the ground, for the simple

reason that the enemy did not know where they were, what they were doing, or where they were going.

No doubt von Kluge tried all the available means of getting information, telegraphed or wireless reports from subordinate commanders or from quislings, reconnaissances by armoured cars, and so on. But the American armour moved so fast that it outstripped the news of its coming, and war correspondents were forbidden to report the steps of its advance.

Not until the Americans had reached Orleans, Chateaudun, Chartres, and Dreux did General Montgomery permit the veil of silence to be lifted, and by then it did not matter much whether German aircraft could or could not catch sight of the Americans. Air supremacy had done its work.

News and the Air

EVENTS in France have moved with such rapidity—to some extent unexpected, one imagines—during the last week or two that it has become somewhat difficult to keep pace with them. We are not referring so much to the scarcity of news from the areas around Paris (which is easily explained by the fact that the enemy is without air reconnaissance and is, therefore, left largely guessing as to the whereabouts of the Allied Forces), but rather to the information now obtainable at SHAEF.

Before the new front in the South of France was opened, accredited war correspondents could get all available news from SHAEF. But since the landings on the Riviera coast the picture has changed considerably. Of the invasion of Northern France General Eisenhower is in supreme command, his second in command of all forces being Air Chief Marshal Sir Arthur Tedder, and the chief of his air forces Sir Trafford Leigh-Mallory.

On the Riviera front General Sir Henry Maitland Wilson is in supreme command, and *his* air chief is General Ira Eaker, of the U.S. Army Air Forces. These two generals receive their orders direct from the Combined Chiefs of Staff, and thus the forces under Maitland Wilson do not come under SHAEF.

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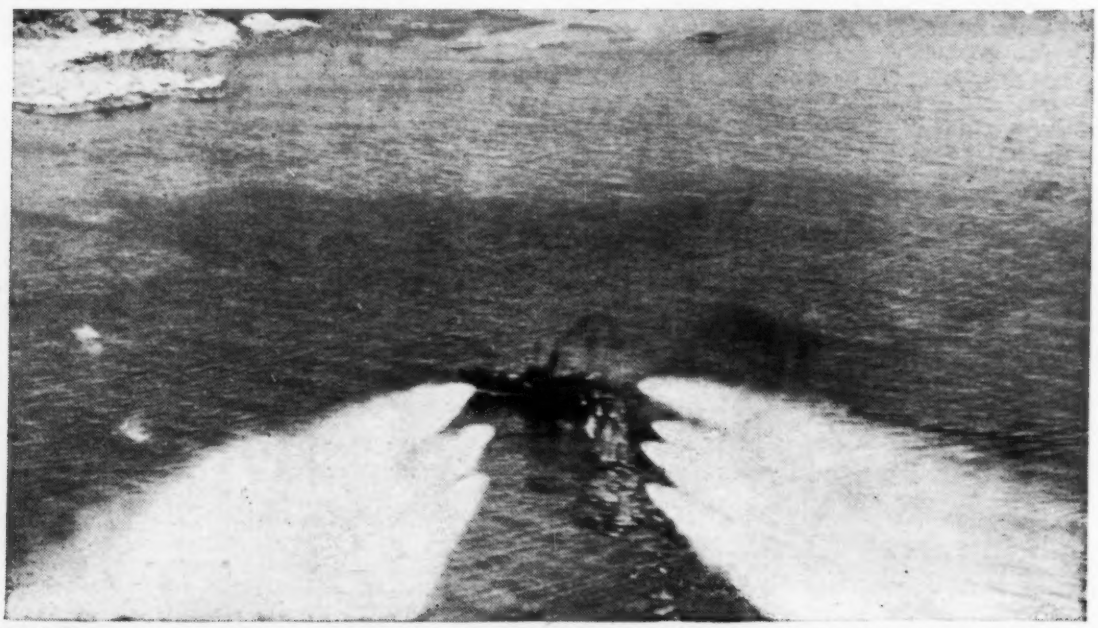
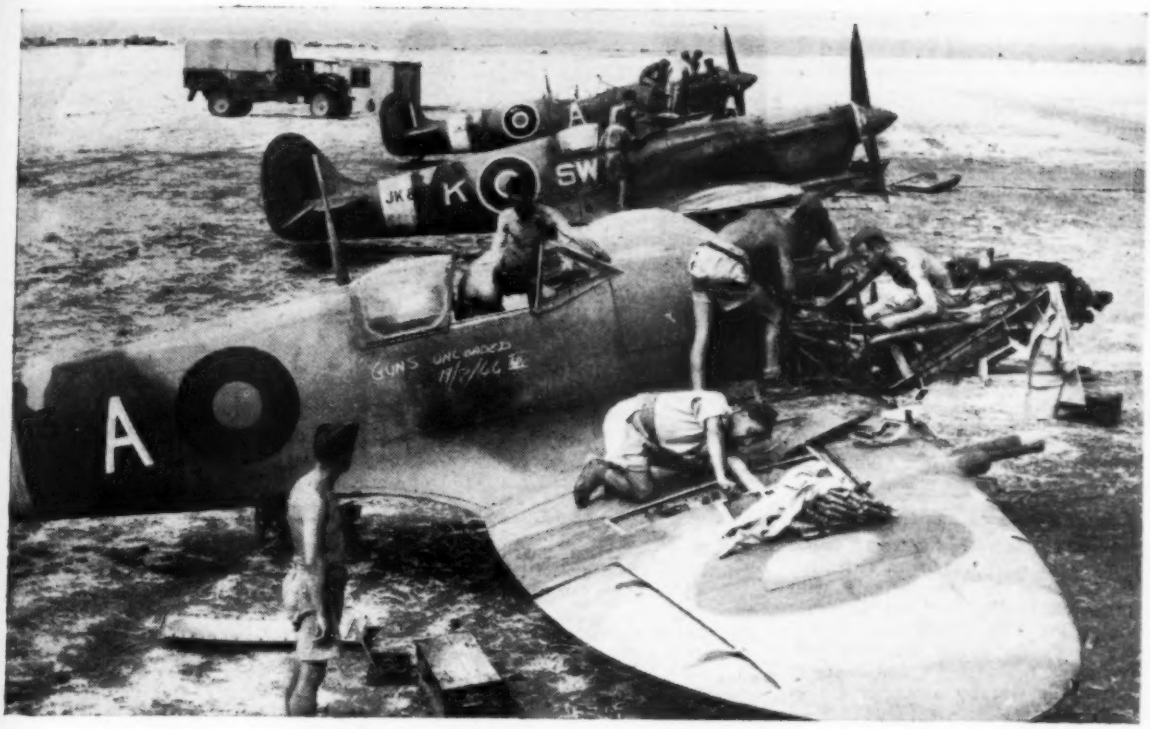
This, in itself, would not greatly matter from the point of view of gathering official news. What makes matters difficult is the fact that the air forces of the Allies are used in so many different ways. One day, or rather one night, the heavy bombers of the R.A.F. strike at targets far into Germany. They are then under the command of Sir Arthur Harris. But the next day, or the day after, the same Lancasters and Halifaxes may be sent against tactical targets in Normandy or Brittany. Then they come under Sir Trafford Leigh-Mallory, and the news will come from SHAEF. It is conceivable that after that they might be wanted for bombing a target on the Riviera, in which case they would come under Maitland Wilson. They might even bomb German targets on their way home, which would be a Bomber Command job, so that news of the two halves of their task would come from Rome and Bomber Command respectively. And now Yugoslavia has entered the air picture too.

Coastal Command is under the operational control of the Admiralty, and little is allowed to become known of its great work.

All this appears to militate against the forming of a correct and coherent picture of the war as fought at present on the Western Front.



BROADSIDE: A salvo of eight rocket projectiles from a Beaufighter on its way to make direct hits on an escort vessel off the Norwegian coast.



Specially selected members of Marshal Tito's Yugoslav Forces are being trained by the R.A.F. in Italy.

WAR in the AIR

German Armies Blinded : No Air Opposition in Provence : U.S. Armour Unharassed in the North

THE Coastal Air Force of the M.A.A.F. did a fine bit of work in preventing the German reconnaissance aircraft from gaining detailed information about the preparations for the Allied landing in the south of France. It takes some doing to conceal the assembly of 800 ships in ports scattered about Italy, Sicily, Corsica, Sardinia, and Northern Africa. The Germans made some half-hearted attempts to get information, but of the reconnaissance aircraft which they sent out the Coastal Air Force destroyed some and drove off the others before they could obtain any valuable information.

The Germans, in fact, seem to have been very half-hearted in all their attempts to meet this invasion. Whether their snooping aircraft could see the congregation of Allied ships or not, they must have gathered that something was in the wind from the preliminary bombing of communications along the Côte d'Azure. Yet their opposition on the ground was feeble in the extreme, and in the air it was non-existent.

BOMBER-FIGHTER ? : Spitfire IX's now can carry one 500 lb. and two 250 lb. bombs when employed on low-level attacks. The wing armament has also been altered to include one 20 mm. cannon and one 0·5in. machine gun in each wing.

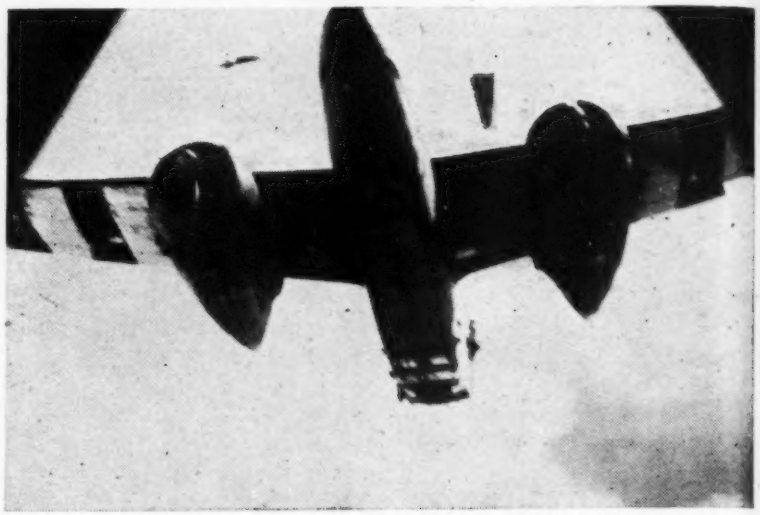
WAR IN THE AIR

This was fortunate for the large force of airborne troops which was sent on ahead of the landing parties in the ships. Parachute troops went first, jumping down in the dark, and just after dawn they were followed by large numbers of gliders. All these men were doubtless inspired by the words which Gen. Eisenhower had addressed to some of their own branch of the Forces just a few days before up in Normandy. Yet, so far as can yet be judged, the defences on the shore were so easily overcome by the infantry that the special merits of the airborne contingent could hardly have been tested on this occasion. No doubt plenty of other opportunities to prove their mettle lie ahead of them.

It is a curious thing that Russia, which first introduced the idea of parachute infantry to the world, is not reported to have made an extensive use of them in her struggle with Germany. In the West, on the other hand, Gen. Eisenhower is obviously very much impressed with the possibilities of these troops, and hopes to shorten the war by a proper use of them.

Heavy Bombers' Part

THE Allied heavy bombers also enjoyed the freedom of action which the absence of the *Luftwaffe* allowed them, for they bombed the gun positions on the shore while the invasion fleet was approaching, and the guns of the Allied warships also joined in. Navy and Air Force are now quite accustomed to taking their share in a land battle; and when we write Air Force we do not mean only the Tactical Air Force, which is operationally an integral part of the Army, but also the heavy bombers which are regarded as a strategic body, intended to carry air war into the enemy's country without any reference to the doings of Army or Navy.



DIRECT HIT: An amazing photograph taken at the moment when an A.A. shell blew the complete tail unit off a 9th U.S.A.A.F. Douglas A20 Havoc. The rudder can be seen between the left engine and the fuselage.

There is one branch of the *Luftwaffe* which is said to be still strong in numbers and high in spirit. That is the body of night-fighters. They do not show up in all the Allied raids on production centres, mainly because these are often so numerous on one and the same night that the commanders of the fighters are left in doubt up to the last minute as to where the chief attack will take place. Nevertheless, it is eminently desirable to reduce the power of this force.

Accordingly, last week a series of very heavy raids was organised by both Sir Arthur Harris and Gen. Spaatz against its airfields. On one day over 1,100 Lancasters and Halifaxes dropped some 5,000 tons of bombs on nine fighter bases. As the raid was made by daylight, the bombers were escorted by both R.A.F. and U.S. fighters, which shot up the dispersal points. On the same day Gen. Spaatz sent out 750 Fortresses and Liberators to attack other *Luftwaffe* bases and airfields. The escorting fighters destroyed a number of enemy fighters in the air and on the ground.

NON-ROLLING STOCK: The railway yards at Vire after attention from Allied bombers.

The Balkan Air Force

SOME information has been released about the R.A.F. Bombing Survey Unit in the Mediterranean. This unit includes a number of scientists, architects, surveyors, and fire experts, and when a place has been captured they examine it with a view to estimating whether it was over-bombed or under-bombed, and whether the best types of bombs were used against each class of target. The findings of this unit are forwarded to London, where they can be studied by commanders of bomber units.

Just about the time when Mr. Churchill and Marshal Tito met each other in Italy it was announced that a new body, to be termed the Balkan Air Force, would be formed out of the M.A.A.F. It suggests all sorts of possibilities, some of which may be connected with Turkey's breach of diplomatic relations with the Axis. Airfields in Asia Minor would be very useful to the Allies in a campaign to liberate the Isles of Greece. Further developments in that quarter promise to be of great interest.

From the North (strictly speaking, we ought to call it the West) as well as from the South comes the news that the German inability to reconnoitre from the air is leading them into grave

WAR IN THE AIR

difficulties. War correspondents, much to their annoyance, were forbidden to mention the movements of the American armour which started off from Brittany, except in the case of the column which reached Le Mans, drove up through Alençon, and arrived at Argentan just at the time when the Canadians forced their way through Falaise. The columns which might not be mentioned reached Orleans, Chartres and Dreux.

The state of affairs in the Normandy pocket was vividly illustrated by the report last week that the opposing forces were so intermingled on the ground that Allied aircraft had to keep clear for fear of hitting friend as well as foe. There had been one unfortunate instance of this when some heavies dropped their bombs among the Canadians.

The attempt of the beaten Germans to cross the Seine opened up interesting possibilities for Allied aircraft. Most of the regular bridges between Paris and Rouen had already been destroyed by Sir Trafford Leigh-Mallary's bombers, but the Germans had constructed pontoon bridges at places. These could be hidden along the banks by daylight and swung into position at night. They were likely to provide awkward problems. The destruction of bridges is a task not much liked by bombers, even in daylight. It is very expensive in the matter of bombs, for near misses are generally useless. Only direct hits are of any avail, and a bridge is a small target.

THROUGH THE OVERCAST: A Lancaster bombs an air torpedo launching site through 10/10ths cloud.

WHEN the Russian armies approached Warsaw, the Patriot forces in the Polish Capital rose and attacked the Germans—prematurely, it seems. They were short of arms, and the British decided to supply them, at least with small arms. So a number of bombers, Halifaxes and others, from Italy made a round trip of 1,750 miles to drop the weapons inside the city to the Patriots. It was a remarkable flight, both for its outstanding navigation and its daring. The visibility was nil for a great part of the way, and clouds were low over the mountains. Over the city the crews flew very low to ensure accuracy in dropping the arms, and they lowered their flaps, reducing speed to 120 m.p.h. The pall of smoke deadened the searchlights, but *flak* was intense.

FROM OUR OWN CORRESPONDENT AT S.H.A.E.F.

THE week at H.Q. has been one of cheerful optimism. When correspondents have been told that there was little news to be had, it usually meant that the news was good but unsuitable for enemy consumption. The air is playing an enormous part on all fronts, and the Allies are to be utterly thankful that their air chiefs were longsighted enough to have enormous quantities of just the right weapons ready at the right time.

The air picture, however, becomes somewhat confused now that the new invasion of the south of France is under way. None of the air activities on this new front is reported at S.H.A.E.F., although the same aircraft may be used on the two fronts. Gen. Eisenhower, with Air Chief Marshal Sir Trafford Leigh-Mallory as his air chief, is responsible for the Normandy-Brittany show, and Gen. Sir Henry Maitland Wilson, with Gen. Eaker as his air chief, is responsible for the southern France attack. All of these commanders receive their directions from the Combined Chiefs of Staff.

Supreme Headquarters is a misnomer. It is not, as might be expected, a focal point for all the European fronts. Some such organisation is urgently needed.

This sort of thing can happen, however: A Halifax or Lancaster takes part in a night attack on German industry. It is not reported at S.H.A.E.F. The same aircraft attacks a German airfield in daylight and that becomes S.H.A.E.F. news. Again, the same machine is employed tactically to start off an attack, either in Normandy or in the south. In the first case it is S.H.A.E.F. news and in the latter case the information is issued via Rome. It makes one wonder what happens if Bomber Command blows up a bridge which has an equal bearing on the two French campaigns.

British Gliders

One of the very "airborne" enthusiasts was at H.Q. during the week and had some interesting sidelights to relate. He was one of the small team who worked with the late Group Capt. Sir Nigel Norman.

The first military gliders employed in this country were peacetime sailplanes which were bought from their owners who were posted from their squadrons to fly them. It was at the time when we were expecting an airborne invasion, and speculation was rife whether there would be enough metal in a glider to cause a reaction on the radiolocation system. These sailplanes were gravely towed out to sea by Tiger Moths and released. The reaction was sufficient. But, thought somebody, suppose the Germans produce a glider in which all the fittings are either wood or plastic. What then? The prospect was terrifying until someone else realised that it was extremely unlikely that the enemy soldiers' rifles would have rubber barrels. From that time, in June, 1940, when our airborne forces consisted of five gliders and three Tiger Moths, a year and a-half elapsed before the General Aircraft Hotspurs began to be delivered. This was no one person's fault. The whole country was bomber-minded, and any idea of invasion of the Continent was too remote to be worried about.

The time did come, however, when one and a-half squadrons went to

WAR IN THE AIR

Africa for the invasion of Sicily. These were towed light all the way from Britain by Halifaxes. Their course lay as far as 11 degrees west to dodge the attentions of Ju 88s operating from the Bay of Biscay. Automatic pilots are used on Horsas and Hamilcars, but these long tows—the Halifaxes had only 30 minutes' fuel left on landing—must have been terribly boring and uncomfortable. These trips, of which nothing has been heard hitherto, were of much greater mileage than any leg covered by the Waco C.G.4A towed from America.

During training in this country, one night must have been exciting when an exercise for landing close together in one area was being carried out. Instructions had got a bit mixed and half the pilots were told to land one way and the other half to land in the opposite direction. A number of gliders became the worse for wear, and the night was illumined by some lurid language; there were, however, no serious casualties.

The Albemarle, which was nobody's baby for so long, has found itself as a paratrooper and tug aircraft. It does the work of a four-engined machine. The Stirling, also, is praised. It seems that both aircraft must have nice flying characteristics and control at low speeds. At one time it was usual to employ 1/3 flap on the Stirling when towing a glider, but this is now discontinued as it was found that too much turbulence was caused and the gliders had a rough passage. Dakotas, too, have been used for towing Horsas, and a number of these Airspeed gliders have been loaned to the American Army. The fact that they carry 25 men as compared with the 15 men carried by the Waco C.G.4A has been found to be a real advantage when numbers of troops have to be put down in a small area.

Unseen Guest

Another good "airborne" story was told by Capt. Alton Bell, of the American parachute infantry. At the time of the invasion, he and some others were detailed to drop at a point which it was expected would make a good command post. The idea was all right except that the German 91st Infantry Division had thought of it first and were already *in situ*. Capt. Bell, with one other paratrooper, found himself taking cover in a ditch only four or five yards away from where the enemy were continually passing. There was, he said, an orderly by the name of Karl who was treated as a general factotum; being called for all hours of the day. With only one K and D ration and a quart of water between them, these two Americans were in this precarious position for more than a day. All the time they were within 1,000 yards of their own troops but dare not move to join them. Finally, however, the Germans had had enough and they pulled out, leaving only snipers and machine gun posts manned.

The captain admitted that a fair proportion of the U.S. airborne troops were dropped in the wrong places and that their losses were heavy. He felt, however, that the losses might have been even heavier had everyone been put down on their allotted spot. I asked him what brand of parachute the U.S. paratroops use but he regretted he did not know; all he bothered about was that it worked, and worked, if necessary, from a height of under 500ft.

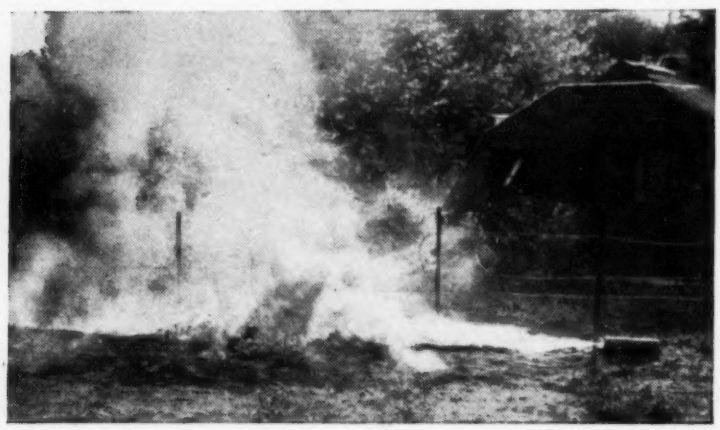
During the week it was announced that the U.S. 9th A.A.F. now has two tactical air forces. Major Gen. Hoyt S. Vandenberg, Commanding General of the 9th A.A.F., disclosed the existence of the 19th Tactical Air Command, which is operating in north-west France under the command of Brig. Gen. Otto P. Weyland.

A NEW INCENDIARY BOMB

A DEVASTATING incendiary bomb has been added to the armament of our bomber aircraft by the research and scientific workers of the Ministry of Aircraft Production. It weighs 30 lb., and the main filling consists of a solution of methane in petrol under pressure. Its descent is controlled by a parachute, which reduces its terminal velocity. The bomb emits from its tail a jet of flame about 15ft. long and 2ft. wide. The length of the bomb is 21in., and the diameter 5.5in.

The bomb is the outcome of long and intensive research by the Ministries of Aircraft Production and Home Security in conjunction with Leeds University. The production and filling stages were done by I.C.I. The team responsible for the introduction of the bomb includes Professor G. I. Finch, M.B.E., F.R.S., of the Ministry of Home Security; Professor D. T. A. Townend, D.Sc., Ph.D., D.I.C., and Dr. E. C. W. Smith, Leeds University; Lt. Col. C. J. P. Bateson and Capt. A. Hayton Cowap, I.C.I.; Sqn. Ldr. D. R. Ashworth, D. Phil, M.A.P.

On impact the striker of the bomb fires the detonator. The flash from the detonator ignites the priming in a central tube. The priming ignites the thermite, and this heats the interior of the bomb, raising the internal pressure. When the pressure has been raised sufficiently the petrol is forced through the flexible tube into the valve chamber, through the outlet hole in the jet, and through the hole in the bottom of the parachute container. As it passes out of the jet, the petrol is ignited by the flame issuing from the vent holes in the striker housing.



The new incendiary bomb is shown on the right at the moment of striking the ground. Above is seen the start of a fire. The cycle in the background gives a good idea of the length of the flame, which burns for about two minutes.

HERE AND THERE

Well Worth It

ACCORDING to a senior officer of A.A. Command, the average cost of destroying a "doodle-bug" by gunfire is £500.

Dirt cheap!

Thundering Good Show!

AT the chief entrance to Republic's Farmingdale plant at Long Island, U.S.A., a scoreboard has been erected showing the losses sustained and inflicted by Thunderbolts.

Latin Co-operation

AT the request of the Bolivian Minister of National Defence, the Brazilian School of Aviation has supplied a squadron of aircraft which has been specially formed to assist in the training of Bolivian flying cadets at Santa Cruz.

The Late Sir William Mitchell

AIR CHIEF MARSHAL SIR WILLIAM MITCHELL, who died suddenly last week from a heart attack, was the first R.A.F. officer to be appointed to the office of Black Rod of the House of Lords, an honour conferred on him in 1941.

A veteran pilot of pre-1914 days, Sir William was also London Commandant of the A.T.C.

"ROCKBOLTS": Rocket-firing Thunderbolts are now operating in several theatres. Here is a P-47 equipped with a nest of three rocket tubes under each wing in contrast with the rail equipment fitted to the "Rockphoon." The P-47's eight 0.5in. machine guns are, of course, retained.

Where's That Tiger!

DISPOSAL of surplus R.A.F. aircraft suitable for clubs and private flying has recently been discussed jointly by the R.Ae.C., the S.B.A.C. and the general council of the Associated Light Aeroplane Clubs. Representatives of the R.Ae.C. have also had an interview with Sir Stafford Cripps, and an early pronouncement on the matter is expected.

Capt. Balfour in Canada

CAPT. H. H. BALFOUR, Under Secretary for Air, arrived in Ottawa early last week for a meeting with Mr. C. G. Power, the Canadian Air Minister. Capt. Balfour went to Canada in connection with the air training programme which will be winding up shortly.

French Flying Hours

A TOTAL of about 40,000 flying hours is shared by some dozen pilots of a French heavy bomber squadron which has dropped well over 1,000 tons of bombs on enemy targets.

Canadian Aircraft for U.S.

CANADIAN aircraft factories are building more than 2,300 aircraft on contract for the U.S. Army and Navy, reports *American Aviation Daily*.

They include the Noorduyn Norseman, Catalina, and Helldiver.

"Nan" Beats "Sugar"

THE record of 114 operational flights recently set up by an R.A.A.F. Lancaster "S for Sugar" has now been beaten by a veteran "Lanc" of R.A.F. Bomber Command, "N for Nan," which recently completed her 115th sortie.

Nineteen of these were to Berlin, and only once has "Nan" failed to reach her target.

Changes in Command

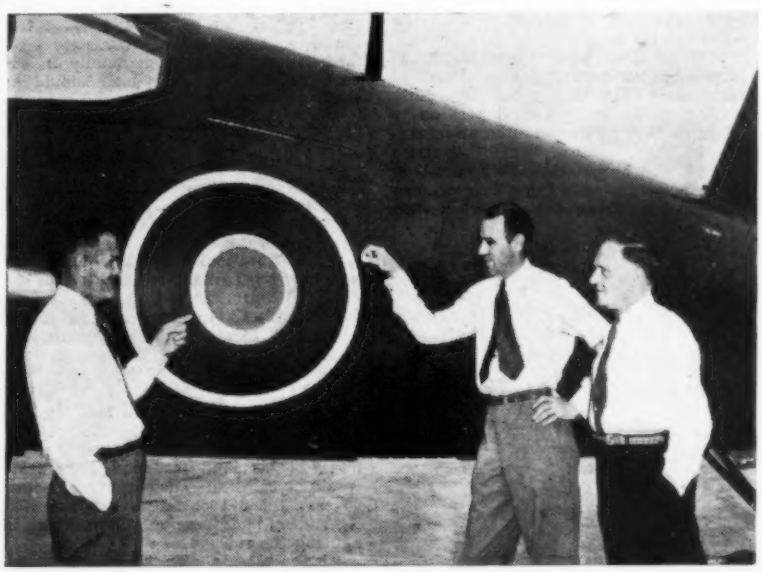
THE appointment of Maj. Gen. Ralph Royce as Deputy C.-in-C. of the Allied Expeditionary Air Force has been announced by Gen. Eisenhower at "Shaef."

At the same time it was announced that Maj. Gen. Hoyt S. Vandenberg, who formerly held this post, has now taken over command of the U.S. Ninth Air Force, relieving Lt. Gen. Lewis H. Brereton.

Human Problems in Industry

DR. MAY SMITH, M.A., D.Sc., Director of the National Health Research Board, will be the speaker at the first autumn meeting of the Supervisors' Discussion Group (Enfield Centre) at Ponders End on September 4th.

The meeting will be in the Enfield



FOR THE FLEET: (Left to right) Mr. H. E. Blythe, vice-president of Goodyear Aircraft Corp., Mr. W. N. P. Edwards of the British Information Service, and Mr. Geoffrey Smith, managing editor of *Flight*, admire the roundel on a Corsair fighter at the Akron plant, Ohio.

HERE AND THERE

Technical College at 7 p.m., and Dr. Smith's subject will be "Fatigue and Boredom," an industrial problem she has been investigating.

Equal Terms

FULLY qualified women flight engineers in the A.T.A. are to receive the same rates of pay, rank for rank, as men similarly employed. Announcing this in the House of Commons recently, Sir Stafford Cripps said the new rates would take effect as from August 1st.

A.T.C. Sports Board

A SPORTS board to encourage sport in the Air Training Corps is in process of formation. The board, which has been guaranteed help from the governing bodies of national athletic associations, will consist of A.T.C. commandants and the secretary of the R.A.F. Sports Board.

Grave of a Pioneer

THE city of Florence, which has been so prominently in the war news lately, has a special interest for Australians; their famous countryman, Bert Hinkler, is buried there.

Hinkler, it will be remembered, met his death in 1933 when, during an attempted flight from England to Australia in a light aircraft, he crashed in the Italian Alps. The Italians erected a fine monument over his grave.

U.S. Output

THE U.S. Aircraft Production Board has announced that the total output of aircraft during the month of July was 8,000—approximately the same as for June.

This is a 5 per cent. drop from schedule, which is attributed to several firms having diverted several days from production to taking inventories, and to certain changes in acceptance procedure of completed aircraft needing "mods."

Russian Veteran

A WHOLE year of flying time—8,760 hours—has recently been completed by the veteran Russian airman, Lt. Col. Vassily Chulkov, who has reached his 25th anniversary as a pilot.

He has flown nearly 1,000,000 miles, carrying passengers and cargo along the Trans-Siberian airline, to the far north, Central Asia, and to the Caucasus. Since war began he has been delivering supplies to all the Soviet fronts from the Arctic Ocean to the Black Sea.

New York—London Record

THE R.A.F. Transport Command Liberator which brought Lord Beaverbrook back from his recent conferences in America flew from New York to London in 17 hr. 34 min., which was nearly three hours better than the previous best time.

The aircraft was the veteran *Commando*, so named when used by Lord Louis Mountbatten, which later hit the headlines when it flew Mr. Churchill to Moscow, Casablanca, Teheran, and other vital conferences.

So far as we know, no Commando aircraft has yet been christened *Liberator*.

SINCERE FLATTERY: A Russian military mission led by Vice Admiral Kharlamov (in dark uniform), inspecting rocket-firing Typhoons while on a visit to the Normandy front. Russian Stormoviks were the first to use this type of projectile.

No More "Ships" Please

THANKS largely to the informative value of the Hollywood film, between wars, most of us already knew that when a member of the U.S.A.A.F. referred to a "ship" he probably meant an aircraft; the equivalent R.A.F. term was 'kite"—much more appropriate, if we may say so.

The American authorities, however, have now officially frowned on this playful misnomer, and U.S.A.A.F. personnel have been asked not to use it as it can lead to misunderstandings; it is to be "plane" in future.

Lay Off, Fellers!

"AERIAL acrobatics, sometimes necessary in combat, will not be permitted by returning combat pilots," says the U.S. War Department, as quoted by our contemporary, *American Aviation*. This official veto on gaily beating-up the home airfield goes on to announce that pilots and aircrews returning to the States from "overseas action" will be put through a course in the principles of safe flying before being reassigned to flying duties in their own country.

Waal! Waddya know!

"One of the dangers of low flying."

The Brabazon I.

IN a statement to shareholders made in advance of the annual meeting, Mr. W. G. Verdon Smith, chairman of the Bristol Aeroplane Co., said that progress had been made with the design and development of the Brabazon I civil transport aircraft, and an increasing proportion of design effort was now being devoted to it.

(Incidentally, Capt. K. J. G. Bartlett, a director of the firm, recently referred in Winnipeg to "a 130-ton luxury job" on which they were working.)

In addition, an extensive programme of other developments, both of aircraft and aircraft engines was in hand.

Mr. Verdon Smith criticised the "increasing load of bureaucratic administration" which war conditions had introduced, and said it was absolutely vital for post-war business, especially in export markets, that this load should be shed.

Black Looks for Blackpool

BESIDES opposition from the neighbouring town of Lytham St. Annes (mentioned in this column last week) Blackpool's ambitious scheme for an Atlantic Terminal Airport is being opposed by the Lancashire executive of the National Farmers' Union, who voiced strong protests against it at a recent meeting in Preston, on the grounds that it proposed to take 5,000 acres of "the most productive land in the county."

Mr. T. Warbrick, of Lytham, is reported locally to have said that the farmers in the area "received the proposal with great alarm," and stressed that the loss of this land for food production would be colossal. The executive decided to seek the aid of the Lancashire War Agricultural Executive Committee in fighting the scheme.

Blackpool has also been rather discouraged by the Lancashire County Council, which recently intimated that they thought it was too big a job to be left in their hands, even if the Government approved the scheme.

London—Paris

One of the two Airco machines which inaugurated the London-Paris service in 1919 was this D.H.16. It carried four passengers.

Twenty-five Years Ago To-morrow the First Regular Air Service Between the British and French Capitals Was Inaugurated

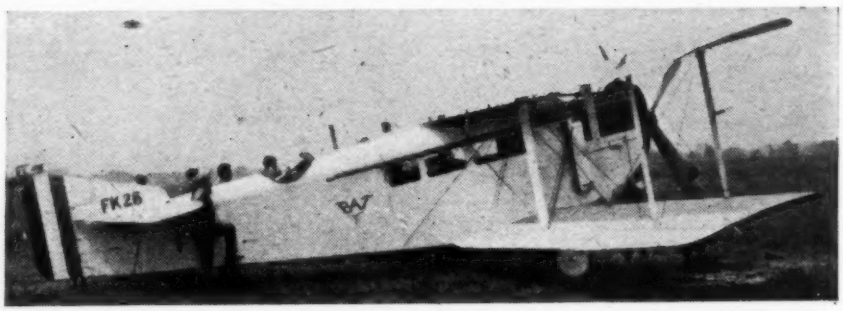
'MONDAY last saw the inauguration of the daily air service between London and Paris, organised by Messrs. Aircraft Transport and Travel, Ltd. Two Airco machines set out from this side and one machine from Paris." In those words was recorded, in *Flight* of August 28th, 1919, the beginning of British commercial aviation. The modesty of the announcement was in keeping with the service, which was flown with converted war-time machines. The word "commercial" is something of a misnomer, for one pilot to two or three passengers could scarcely be considered a commercial proposition, especially since the pilots were (one hopes!) well paid. They certainly ought to have been, for on their skill and judgment depended the lives of the passengers, far more than is the case in modern times. It must be remembered that these heroes had to navigate without radio, and in thick weather they had perforce to fly low so as to pick up known landmarks as they went along. That does not sound quite so daring nowadays, but in those days engines had not reached the wonderful reliability which we now take for granted. Forced landings were fairly common occurrences, and when flying "by Bradshaw," as we used to call the practice of following railway lines so as to avoid getting lost, many a pilot had to put his aircraft down in most unlikely places. It speaks well for their skill that they nearly always managed to pull off fairly safe landings. In this they were, of course, helped by their low landing speeds.

But to return to that historic day of August 25th, 1910, *Flight* recorded that an Airco 4 biplane left Hounslow at 9.10 a.m. piloted by Lt. E. H. Lawford and carrying one passenger, a number of newspapers, a consignment of leather, several brace of grouse, "and a considerable number of jars of Devonshire cream." It arrived at Le Bourget at 11.40. Actually, the Airco 4 was not on the regular run, which was made later by an Airco 16 piloted by Major Cyril Patterson, who carried four passengers. The machine left Hounslow at 12.30 and landed at Le Bourget, Paris, at 2.45. The first return flight was made by an Airco 4A. This was piloted by Lt. J. McMullin, and one of his passengers was Lawford, who had piloted the early machine to Paris.

A converted Handley Page 0/400 bomber carried 14 passengers to Paris on August 25th, 1919.

LONDON-PARIS

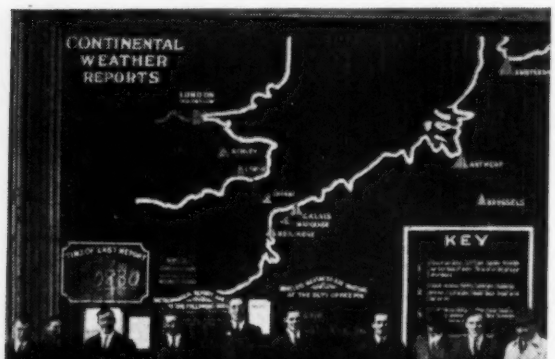
The Handley Page London-Paris service did not actually start regular operation until the following week, but a machine flew to Paris on August 25th, piloted by Major Foot. It carried 14 passengers, and was thus the first large British twin-engined commercial machine to touch down at Le Bourget. The Handley Page 0/400 left Cricklewood at 8.30 a.m., called at Hounslow for Customs and landed at Le Bourget at 1.15 p.m. It does not seem to have been wildly fast, which recalls a later Handley Page, the *Hannibal*, of which a wit (? the late Sydney St. Barbe) once said that it was as steady as the Rock of Gibraltar—and nearly as fast!



The B.A.T. F.K.26 was the first aircraft initially designed for commercial flying. It made its appearance early in 1919 and was designed and built by Mr. F. Koolhoven. The machine did not come into general use on the regular air routes.

Simple Equipment

Our younger readers will probably have little conception of what those early "commercial" aircraft types were like. The Airco (the letters were a contraction of the title of the Aircraft Manufacturing Company) machines were converted from military biplanes, the conversion consisting chiefly of adding a "lid" over the passengers' cockpit. They were designed by Capt. (now Sir Geoffrey) de Havilland, who at that time was chief Airco designer. Many of those who are now his co-directors in the De Havilland Aircraft Co. were working with him in those days, such as Messrs. C. C. Walker, F. T. Hearle and F. N. St. Barbe. The Airco (D.H. 4A) had a span of 42ft. 4in. and a wing area of 434 sq. ft. The D.H. 16 was very similar, but slightly larger, with a span of 46ft. 5in. and an area of 436.5 sq. ft. The 16 was actually a converted D.H. 9A. Both had Rolls-Royce engines of about 350 h.p.



PRIMITIVE METEOROLOGY: This map was painted on the wall of a hangar and the information it gave was often somewhat scanty. Of radio aids to navigation there were none when the London-Paris air service started twenty-five years ago

The Handley Page commercial biplane was a converted 0/400 bomber. It could carry a total of 18 passengers, 14 inside the cabin and four "outside." As in the case of the Airco machines, the 0/400 had Rolls-Royce Eagle engines (two), but they were mounted in the gap between upper and lower planes. Later in 1919 Handley Page also started a regular air service between London and Brussels.

From those early beginnings grew the network of air routes which, in a few years, were to include almost the whole of Europe. The converted military aircraft were gradually replaced by more suitable types; direction-finding wireless came to the assistance of the pilots; engine reliability improved until forced landings due to mechanical defects became rare occurrences; the almost unbearable noisiness of the early types was remedied, in part at least, by attempts at soundproofing the cabins.

Operationally the greatest change came when the individual companies, having fought a gallant but somewhat hopeless fight against foreign government subsidised airlines, notably French and German, were amalgamated into Imperial Airways. That firm was given a monopoly and was due to receive, over a certain period of years, something like £1,000,000 in subsidies. These were to be decreased on a sliding scale, in the pious hope that some day commercial aviation would be able to "fly by itself." To-day it should be a good deal nearer to that praiseworthy ideal, although there must be, after this war, some routes which it is desirable to operate but which cannot, for a long time, hope to become self-supporting.

Tribute to Pioneers

A tribute has already been paid to the pilots who pioneered the early air routes. Their work, dangerous and, in many ways, thankless, laid the foundation for safe commercial flying as we knew it before this war set back the good work, and the vastly greater benefits which it will confer when the present strife is ended and the world is able to return to sanity once again. But we should also remember the designers and constructors who, more often than not without much encouragement from parsimonious governments, strove to improve the breed of commercial aircraft by giving us greater safety, greater comfort, greater speed, and a very high order of reliability. Their genius is still as vigorous as ever, and if Great Britain fails to hold her own in post-war commercial aviation the fault will not be theirs. It will be because political considerations keep from them the opportunity to produce the world's best aircraft in their class.

MORE SHIPPING APPLICATIONS TO C.A.B.

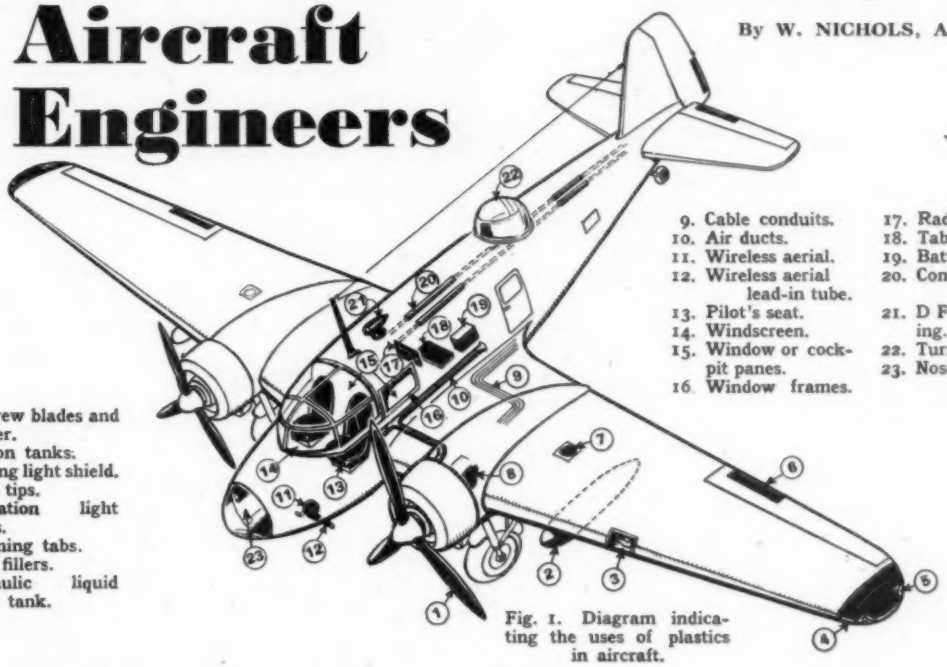
THE Moore-McCormick Shipping Lines have filed an application with the Civil Aeronautics Board for permission to operate an international air route, one leg of which, starting from New York, would include Botwood (in Newfoundland), Greenland, Reykjavik (in Iceland), Oslo, Stockholm, Helsinki, Leningrad, Moscow, Teheran and Basra. The other leg would operate from New York to Bermuda, the Azores, Paris, Amsterdam, Hamburg, Copenhagen, Stockholm to the above points.

The Grace Shipping Line has also applied for a permit to operate an air line between New York and the Bahamas, the Dutch West Indies, Central America, and Jamaica. This planned air route would run parallel with the company's steamship route to the Caribbean Sea and the north coast of South America, so that schedules for aircraft and ships would be co-ordinated. It is planned to make fares on both services as uniform as possible, and tickets will be interchangeable.

Plastics for Aircraft Engineers

Basic Principles of Moulding, with Hints on Design

By W. NICHOLS, A.R.Ae.S.



1. Airscrew blades and spinner.
2. Jettison tanks.
3. Landing light shield.
4. Wing tips.
5. Navigation light covers.
6. Trimming tabs.
7. Tank fillers.
8. Hydraulic liquid header tank.
9. Cable conduits.
10. Air ducts.
11. Wireless aerial.
12. Wireless aerial lead-in tube.
13. Pilot's seat.
14. Windscreen.
15. Window or cockpit panes.
16. Window frames.
17. Radio panel.
18. Table tops.
19. Battery case.
20. Control wire guards.
21. D F aerial housing.
22. Turret.
23. Nose window.

Fig. 1. Diagram indicating the uses of plastics in aircraft.

THE illustration in Fig. 1 gives an excellent impression of the application of plastics to a modern aircraft, and leaves one in no doubt that the aircraft industry is at the present time one of the largest users of plastic materials. One of the most prominent materials is the transparent plastic known in this country by the trade name of "Perspex." Also various laminated plastic materials are now being employed for various components with success, whilst modern plywood, using plastic adhesives and moulded plywood construction indicate a return once again to the oldest of all materials in the history of aircraft engineering, the principles of design and the manufacturing technique now being well known and appreciated.

In every modern aircraft, however, are to be found, in addition, a host of small plastic mouldings involving quite a different manufacturing technique, and such parts are constantly being increased as this modern drama of raw materials, being transformed rapidly and economically into a multitude of useful gadgets and decorative objects, becomes more generally appreciated by enterprising designers and technicians. Some knowledge of the basic fundamentals of the moulding processes for such parts is advisable prior to projecting an aircraft equipment unit to be made wholly or in part of plastics, and is the primary purpose of this article, concluding with notes on design which the aircraft draughtsman in particular may find of some value.

Cast Plastics

Of the various processes, cast plastics will be dealt with first. These comprise those thermosetting materials which may be poured as liquids into suitable moulds to fix their shape, and then hardened by means of an after-baking operation. Inexpensive lead moulds are used, and where standard shapes or sections are required these can be cast in long rods and cut off or sliced into small sections, having the shape or contour provided by the casting process. Phenolic resins used in this process are prepared differently from the phenolic moulding materials; the hardening makes use of the same basic chemical reaction of polymerisation, changing the molecular structure and producing a new material which cannot be melted again. The resins, however, are modified to meet the special requirements for casting and hardening.

Compression Moulding

The compression moulding process is used for thermosetting materials such as the urea and phenolic compounds which not only require heat for plasticisation but also the application of heat for a period of time to polymerise or set them. Thermoplastic materials require cooling in the mould and can be moulded more economically in injection-moulding machines. By the compression process the material is loaded directly into the mould cavity, as shown in Fig. 2, and compressed to the required density by the pressure, the material being confined to the shape of the mould. Continued heat and pressure produce the chemical reaction which hardens the compound into the finished moulded product. Economical commercial moulding by this process depends mainly upon ease of loading, correct heat and proper application. For example, the heat must be applied simultaneously to the material charge and to the part while undergoing hardening. Proper pressure is

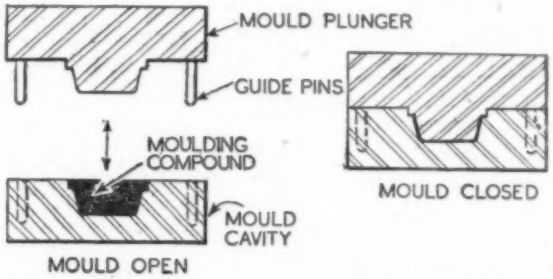


Fig. 2. Compression Moulding. The moulding compound takes shape under heat and pressure and is maintained in this form until the material hardens.

PLASTICS FOR AIRCRAFT ENGINEERS

also important, large flat shapes requiring greater pressure where there is a compressive rather than a flowing action. Minimum pressure is required for flash-type moulds, especially in fabricating simple shapes. Finally, it must be possible to remove the moulding without damaging or distorting it.

Transfer Moulding

Transfer moulding is a patented moulding process, but it is now being widely used. In this method the material is plasticised by outside heating in a cylinder separate from the mould proper, and then as a hot plastic it is transferred through an orifice into the hot mould where it is to be set or hardened. The method is particularly advantageous where the design requires delicate insets, or maybe an intricate shape, and also where large variations in wall thicknesses are unavoidable. Many jobs which cannot be done satisfactorily by compression moulding are possible by the transfer moulding process. Since the material flows into the mould cavity as a liquid no large stress is built up to break the mould parts and displace the inserts. Glass and fine wires have been moulded in parts without distortion or breakage. The process is shown diagrammatically in Fig. 3.

Injection Moulding

The most successful and widely used method of moulding thermoplastic materials is the injection moulding process. These cold-set materials require heat to plasticise them and require cooling for hardening. The process is similar to transfer moulding in many respects and is shown in Fig. 4. Here also the material is heated to a sufficiently plastic state in a heating chamber, then forced by pressure plunger through an orifice into a relatively cool mould where the moulding is formed and hardens on cooling. The time for the moulding cycle is short, since the parts can be chilled very rapidly and all operations of the machine are automatic.

The principles for economical injection moulding differ from those of compression moulding. In this case the feed of the material must be uniform and of proper quantity. Due to insufficient material short castings will result, whilst too great a feed will cause flashing of the mould, or possibly choking of the machine. Optimum temperature of the material in the heating cylinder must be constantly maintained and variations in time cycle and temperature should be minimised. The amount of heat required is determined by the plasticity of the moulding material as well as the pressure, and the overall cycle, the minimum amount necessary being used. The lower the heating cylinder temperature, the smaller the chances of burning and leakage of the plastic from the nozzle of the heating cylinder.

Temperature and effective pressure must be kept constant and to ensure that the moulding may be ejected without damage or distortion; it must be cooled to a point where it is sufficiently rigid to withstand slight deformation. The temperature of the mould, and temperature of the injected material, length of time the material is chilled in the die and the rate and means of ejection are factors which must be carefully regulated and controlled with this process.

TABLE 1

Average Mould Shrinkage	Inches per Inch
Phenol Formaldehyde :	
Wood-flour filled	0.008
Mineral filled	0.004
Fabric filled	0.005
Urea Formaldehyde	0.008
Polystyrene	0.005
Cellulose Acetate	0.005

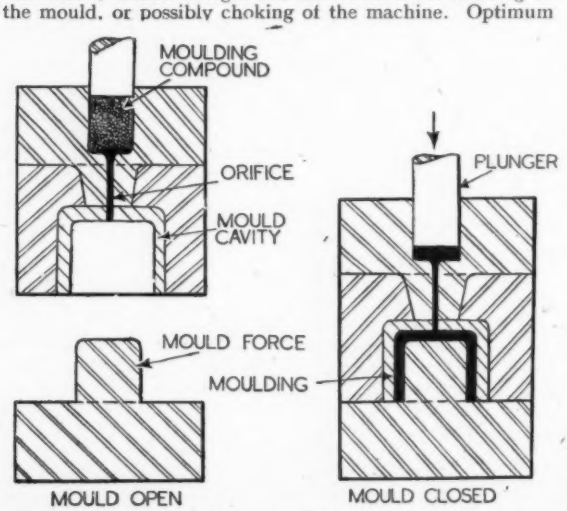


Fig. 3. Transfer Moulding. The material as a hot plastic is transferred via the orifice into a hot mould where it hardens.

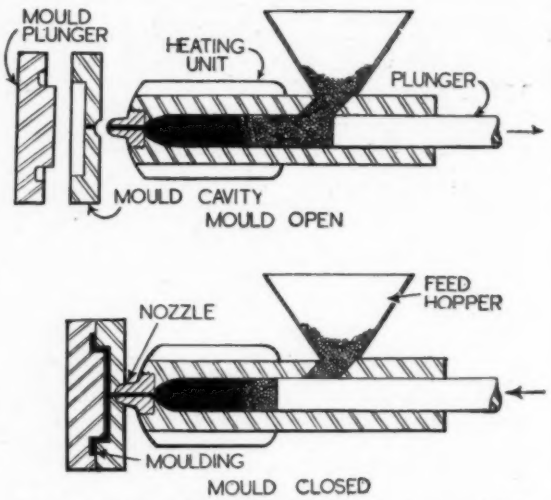


Fig. 4. Injection Moulding. Heated plastic material is forced by the plunger through an orifice into a relatively cold mould where it hardens on cooling.

The foregoing brief discussion is intended to provide a picture of the various processes and the necessary procedure adopted to produce the numerous small plastic mouldings peculiar among modern aircraft equipment. An individual job, however, may offer problems which cannot be overcome without careful study of the specific details of the design and early consultation with the plastics engineer may be advisable prior to final designs being made.

Factors in Design

From the engineer's point of view plastics are relatively new materials possessing inherent advantages in many ways over other materials. On the other hand, having certain limitations, the same intensive study prior to selection of process to be used and care in design must be exercised to take into account the advantages and limitations of the material, its fabrication, finish and relative cost. In designing moulded plastic parts as already emphasised, the first and most important feature is to ensure that the piece will be easily removable from the mould, otherwise complications may arise and production costs increase.

With reference to tolerances, these points should be observed. Vertical dimensions parallel to mould pressure

require large tolerances. The shrinkage of material, average values for which are given in Table I, must be considered, and will largely depend upon mould design, the condition of the material, and the moulding process. When considering warpage 0.003in. per in. from the average plane through warped surfaces is a good working tolerance. For close dimensional accuracy, grinding or machining of the part is recommended.

The tolerances in Table 2 may be used only as a guide, since it is practically impossible to prepare a tabulation of limits which can be universally applied to all designs. Limits should be required only on dimensions which must be accurately held to permit of assembly and operation in use. The tolerances in Table 2 apply to dimensions given in fractions or to decimals with no stated tolerance and also in particular to such dimensions as pin centres, etc. On hot-moulded parts it may be essential to have greater accuracy, but except in cases where shrink fixtures can be used to hold very accurate dimensions, tolerances closer than those given in Table 3 should not be requested.

TABLE 2.—TOLERANCES

Nominal Dimension (Inches)	Tolerances Above and Below Nominal Dimension	
	Hot Moulded	Cold Moulded
¼	0.003	0.009
½	0.005	0.011
1	0.008	0.014
2	0.010	0.016
3	0.012	0.018
4	0.015	0.020
5	0.015	0.023
6	0.015	0.028
7	0.020	0.032
8	0.020	0.036
9	0.020	0.040
10	0.025	0.048

TABLE 3.—TOLERANCES

Nominal Dimension (Inches)	Tolerance Above and Below Nominal Dimensions
0.500 or less	0.002
0.500 to 2.0	0.005
2.0 or over	0.0025 per inch

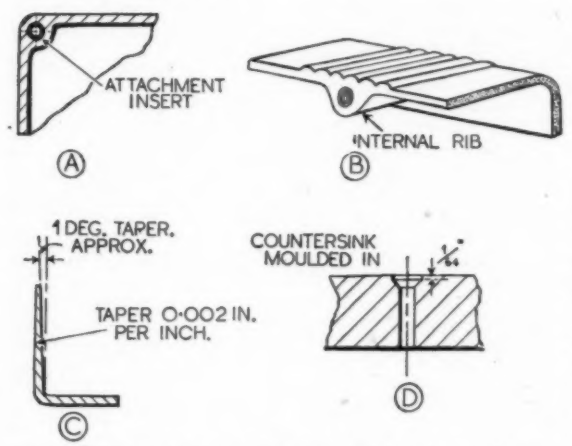


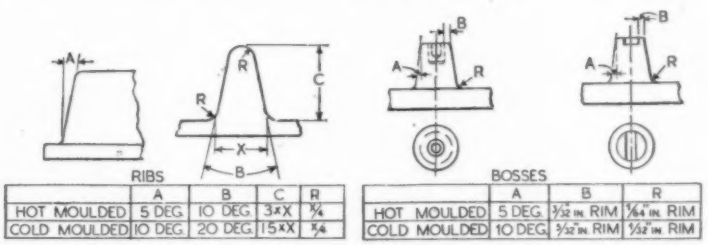
Fig. 5. Design hints. (a) Placing attachment inserts at corners strengthens the moulding; (b) where an internal rib is used, surface decoration on the opposite side will eliminate flow lines; (c) a slight taper facilitates removal from mould; (d) moulded-in countersink is preferable. Dimensions shown permits screwhead to fit below surface.

Wall Thickness

The wall thickness of moulded plastic parts should be decided upon with great care. A minimum thickness is desirable for fast curing time and economy in material, but it must be borne in mind that plastic mouldings are brittle, and selection of thin sections may involve breakages in use. A wall thickness of $\frac{1}{16}$in. may be used for small phenolic or urea mouldings, but a better choice would be $\frac{3}{32}$in. Other details are shown in Fig. 5. Uniformity of cross section will produce a more uniform cure and less after-shrinkage and distortion of the thermosetting materials, whilst thermoplastic materials may develop "sinks" or small concave surface disfigurations, over areas having greater bulk than surrounding areas. Ribs may be used freely to stiffen thin sections, minimise warping and increase strength. Recommended proportions for such ribs are illustrated in Fig. 6.

Inserts

In the design of inserts care should be taken to provide sufficient anchorage for parts which are subjected to strains in service, and such inserts are normally anchored by



	A	B	C	R
HOT MOULDED	5 DEG.	10 DEG.	3×X	¼
COLD MOULDED	10 DEG.	20 DEG.	1·5×X	⅛

	A	B	R
HOT MOULDED	5 DEG.	1/32 IN. RIM	1/64 IN. RIM
COLD MOULDED	10 DEG.	1/32 IN. RIM	1/32 IN. RIM

Fig. 6. (Above) Recommended proportions for ribs and bosses.

Fig. 7. (Below) (e) Avoid thick uneven sections where gas pockets may form; (f) domed sections reduce warpage and assure better distribution of stress.

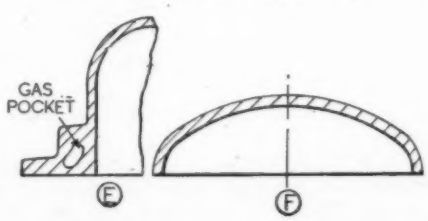
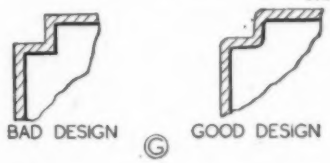
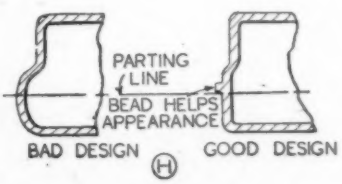
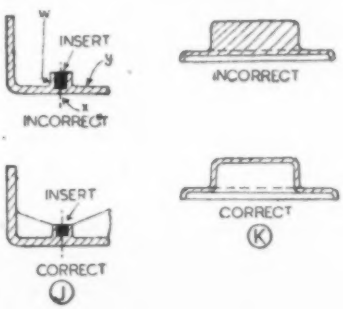


Fig. 8. (Bottom centre) Good and bad practice (g) left. Sharp corners make moulds expensive, material flow is poor, stresses concentrate at corners causing cracking; (h) left. Curved surfaces at parting line are expensive to machine. A better design is shown on right.

Fig. 9. (Bottom right) Correct and incorrect. (j) Top. Poor material flow to boss at "w," part may dimple at "x" and is weak at "y." Below ribs allow better flow of material and provide strength. (k) top. Thick—thin sections set up strains. Thick sections also require longer cure. A uniform section below means uniform shrinkage and better stress distribution.







PLASTICS FOR AIRCRAFT ENGINEERS

knurled surfaces or grooves, etc. Ample provision must be made for holding the inserts in place during the moulding operation, usual methods being the use of plain or threaded pins, recesses in the mould or clamping arrangements. To reduce cleaning costs inserts should be sealed against compound leakage, and various methods to accomplish this are shown in Fig. 10. Also studs should have a base of larger diameter than the projecting body, thus providing a shoulder to rest upon the mould. Where two inserts are located upon opposite sides of the moulded part, the distance between them should not be less than shown in Fig. 10. Inserts passing completely through a part and flush on one or both sides of such part should be avoided, as they are apt to be crushed during the moulding operation. Brass is most frequently used for inserts because of its machineability and also inserts of this material cause less damage than would steel inserts should they come in contact with the mould surface.

Threads

Threads may be moulded in a part on an axis parallel to the mould stroke. Moulded threads can be unscrewed from the steel cavity, or separate thread plugs may be used. With plugs the complete moulding is removed and the plug unscrewed while the moulding production continues on the next piece. On parts of undercut design it is impracticable to unscrew the moulded piece from the mould, the parting can therefore be made along the thread centre line and a sizing-die run over the thread to remove flash. Threads should be started at least $\frac{1}{32}$in. from the end of the face perpendicular to the axis of the thread, thereby resulting in a stronger moulding and eliminating the possibility of a feather edge on the moulded part, as shown in Fig. 10. No more than 32 threads per inch should be specified. With

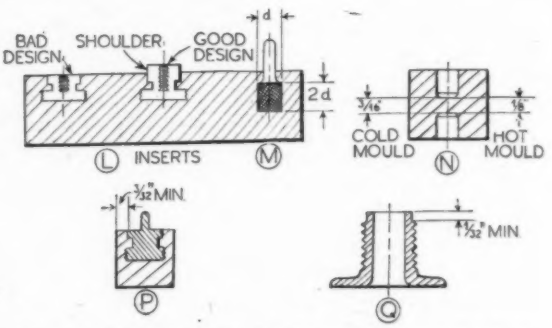


Fig. 10. (l) Insert with shoulder prevents material from reaching thread ; (m) Length of projection may vary due to inaccuracies in seating and supporting ; (n) Distance between two opposite inserts should not be less than shown ; (p) minimum wall permitted around inserts ; (q) start moulded threads at least $\frac{1}{32}$in. from end face.

holes $\frac{3}{16}$in. diameter and less which are to be tapped, a slight countersink in the moulded piece should be provided, permitting easy entrance and withdrawal of the tap. Further hints on design of moulded plastic parts are shown in the illustrations Figs. 7 to 10 inclusive, but this brief treatise by no means exhausts the modern technique of moulded plastics design. The continuous and low cost production of moulded parts for aircraft equipment will, however, be maintained as the direct result of full considerations being given for the problems associated with mould design and manufacturing technique by aircraft technicians and equipment designers.

TRACK MESH FOR AIRSTRIPS

TRACK mesh of various types for emergency airfields has been tried, but the principal type being manufactured to-day is made from all-welded drawn wire mesh.

Before the war reinforcement for concrete was made by using drawn wire and welding it at all cross-sections. When this material was first tried out for use as emergency landing strips, the standard type of 6in. tack-welded mesh was found to be quite unsuitable and the manufacturers offered a closer mesh, 3in. × 3in., made of a standard-gauge wire, but even this showed weaknesses. The main weakness was that the welding was not strong enough, and experiments carried out by the various manufacturers, at the request of the Ministry of Supply, finally provided a material with cross-section welds as strong as the wire itself, and a considerable quantity was rejected before satisfaction was given.

There is no patent whatever in welding wires into a square mesh, and therefore all the manufacturers in the country with machines capable of doing the work had to concentrate on the manufacture of what is now termed square mesh track. To facilitate handling and transport, square mesh track is made in standard widths of 7ft. 3in., this being the widest universally obtainable amongst British manufacturers, and in lengths of 77ft. 3in., this making a roll of approximately 5cwt.

During the course of manufacture, many slight variations were magnified on this close mesh with much deeper penetration welding, one of the main troubles being to fix the material in a flat condition on the site. The wire from which the material is made is specified to come within the range of 35/43 tons tensile. The welds have to be as strong as each wire, and the outside projections have to be sheared off flush to prevent tyre wear.

Methods of Joining

For joining the rolls together when unrolled flat, various types of clips have been used and two in particular have been concentrated upon. One type of clip sometimes seen in photographs of landing strips overseas is quite simple for very quick jointing. Another, which is folded round the mesh, while looking lighter, provides a very secure joint. After clipping, picketing has to be carried out and the type of picket varies according to the ground on which the track is laid. On some sites ordinary hooked bars are sufficient, but on others a long corkscrew type of specially made bar has been found necessary.

Each roll, when sent overseas, or when sent to a site, has to measure 7ft. 3in., the width of the fabric, by a diameter of not more than 25in., and this provides 62 sq. yd. of landing strip. It will therefore be seen that approximately 900 rolls are required to provide a landing strip 1,000 yd. long by 50 yd. wide: and the speed with which Sappers and Pioneer Corps lay these strips proves that thought has gone not only into the manufacture but the method of fixing.

All the manufacturers of this standard deep-weld-strengthened mesh capable of making it are busy on it.

BACK FROM AUSTRALIA

SIR OLIVER SIMMONDS, M.P., returned last week from Australia which, as head of the Simmonds Group, he has been visiting at the request of the Australian Government. He made his whole journey by air, outwards across America and homewards across Canada, and in total flew some 33,000 miles. His flying time from London to Melbourne, a distance of 16,000 miles, was only 96 hours. He said that the weather throughout the time he spent in the air had been excellent, and the bumpiest part of the journey was on some of the improvised roads between the landing strips and the hostels in some of the Pacific islands.

He met the British Commissioners in a number of these islands, and learned of the conditions both on the Japanese invasion and after their expulsion.

Sir Oliver spent several weeks in visiting the various units of the aircraft industry in Australia, and felt that a very remarkable production record had been achieved. Australia was now building aircraft to the finest and most advanced British and American designs, in addition to several types of aircraft engines, and hardly an alloy or a component was now imported. For a young industrial country this was a wonderful achievement, and Australia could well be proud of it.

Behind the Lines

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

Ops.

FIGHTER, A.A. and signal units of the *Luftwaffe* are taking part in operations against Yugoslav patriots.

Film

THE leading feature on German newsreels this week is reported to be the first film showing how the air torpedoes are launched against this country.

Jap Man-power

MORE men are to be released for Japan's army, air force and navy by a further mobilisation of women. A report from Tokyo says that in future women will form 60 per cent. of the personnel of public utility services.

Tribute to Mosquito

"EVERY German who has once gone through a nuisance attack can testify from his own experience that the enemy nuisance raiders, both by virtue of their wide range of action, their speed and bomb-load, have become dangerous enemies," says a German war reporter.

In an article describing the different functions of the Mosquito the writer pays an unwilling tribute to this aircraft, which he qualifies as the type "which best fulfilled the demands for fast night attacks."

Replacements

FROM Zagreb it is reported that a squadron of Croat bombers left Croatia to reinforce the badly mauled Croat Airforce Legion on the Russian fronts. It will be remembered that Croat units have been on the Russian front since 1941, and in 1942, when attached to Von Richthofen's Air Corps, they had suffered severe losses during bitter fighting on the South sector of the front.

The present reinforcements are said to be composed of volunteers trained in the Reich.

Galland's View

MANY Germans will find the optimistic statement made by Maj. Gen. Galland, Inspector General of the *Luftwaffe* fighter forces, an acknowledgment of the inferiority hitherto displayed by the *Luftwaffe*.

In an article in the *Berliner Börsen Zeitung* on the future of the German airforce he disclosed that the quality of German fighter aircraft has recently considerably improved.

So far as replacements are concerned, Galland asserts that Germany produces to-day far more fighter aircraft than are lost on the fronts and over the Reich proper.

V.1—

COMPETENT Berlin circles point to the marked intensification of the V.1 in recent days, says the German Telegraph Service.

Quoting an "unofficial report," the statement says: "The reasons for this are to be sought in a strong increase in German production and the improved aiming devices of the flying bomb, which make it possible to obtain sure hits on squares containing war-important objectives in the Greater London area through a system by which h.e. V.1 alternate with incendiary V.1s." These quarters say that the use of V.1 represents, from the technical point of view, the first step into the era of the rocket. The next step will yield results described as astounding even measured by the standards of this modern weapon.

"In view of its speedy development and successes, it is extremely difficult to determine at this juncture the limits of the future speed, range and weight of the bomb or of the effectiveness of new explosives which have stood their trial.

"In any case"—concludes the report—"Berlin circles consider that the rocket bomb as an offensive weapon is still in a state of progressive development."

—and V.2

"The V.2 is not a variation of the torpedo but a completely new secret weapon," says the Berlin correspondent of a Swedish paper.

The credit for the development of the new weapon, which is said to be now ready for launching, goes, according to Berlin quarters, to all four branches of the *Wehrmacht*; the army's contribution was made in the sphere of ballistics, the navy and air force assisted in the development of the sight-control aiming apparatus and the *Waffen-S.S.* "has contributed in the sphere of tactics."

Party Not Trusted

"THE *Drahtfunk* has proved its value on many occasions, but is not a life insurance," says a German newspaper.

In an attempt to satisfy the complaints about the inefficiency of the wireless warning system, the article says that "unfortunately the bombers are not bound to some time-table. They only reveal their intentions and aim at the last minute, and in these circumstances the work of the air reporters is not easy, *nor is it, as many people believe, in the hands of the Party. . .*"

Aces

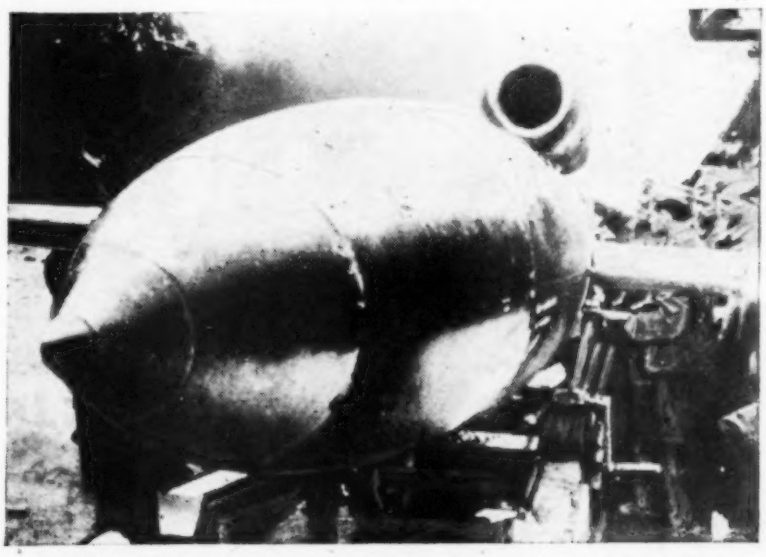
PUBLICISED as Germany's most successful night fighter pilot is Lt. Col. Lent, Commodore of a fighter *Geschwader* and holder of the Oak Leaves with Swords Insignia. He is credited with one hundred victories in night fighting, all against British bombers.

Lt. Col. Hans Steinhoff, Commodore of a fighter *Geschwader*, who is credited with 168 victories was awarded the Oak Leaves with Swords. But, according to the German News Service Capt. Weissenberger, commander of a fighter *Geschwader*, shows even a better balance sheet with 200 aircraft to his credit.

For Total War

THE first indication of German attempts to enforce a total mobilisation in Denmark is the census now being taken of all the local industrial facilities.

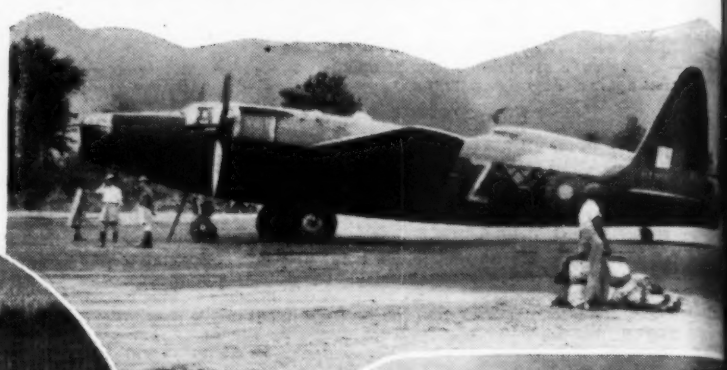
The *Rüstungstab* Denmark have asked for information on the following points from large local factories: What is available in the way of lathes, turret lathes, drilling, milling, welding, sheet processing and grinding machines, etc. How many officials and workers are there, how many hours of work are done per week, the number of teams of workers in each shift, what is manufactured, the number of sabotage guards.

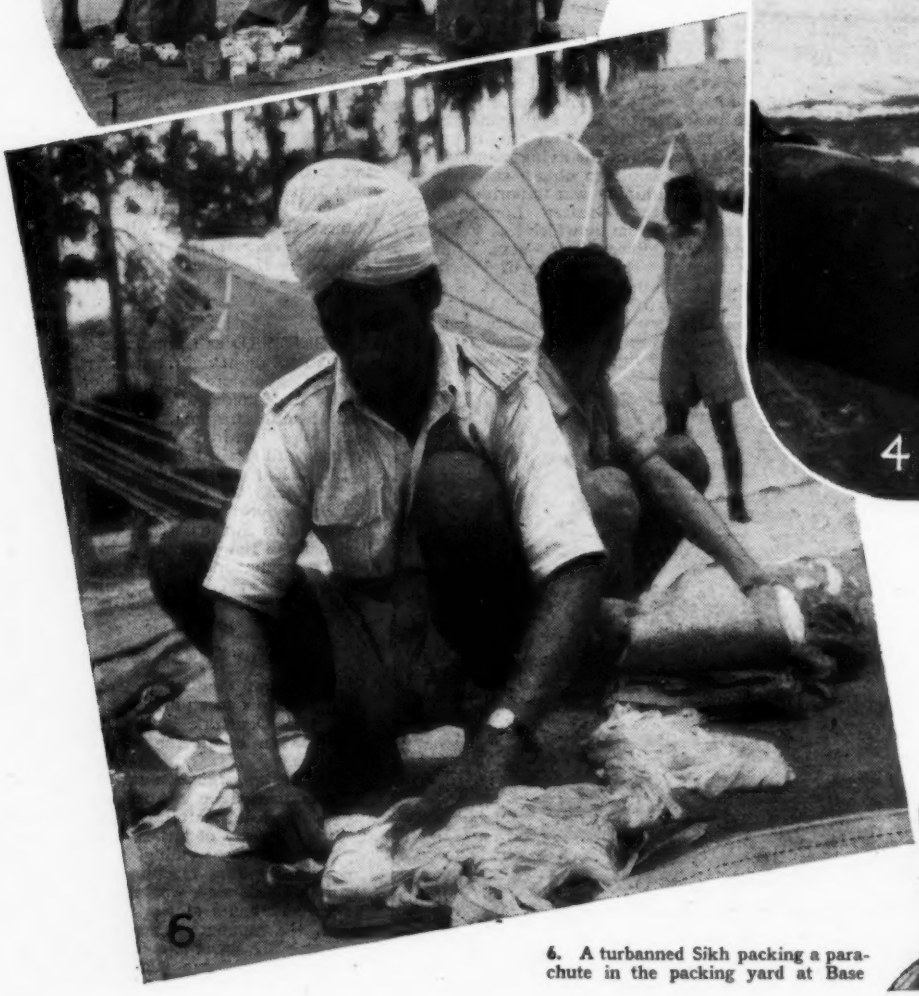


CLOSE-UP: A German picture showing the air torpedo in transport from the storage place to the launching ramp.

By Air in Burma....

R.A.F. Transport Command Supply Troops Fighting in the Jungle : Lack of Communications Overcome





6. A turbanned Sikh packing a parachute in the packing yard at Base

3. A D.C. 3 taking off. The Indians in the foreground are draining a swampy area.

5. Instead of working at a long table, as used in England, the Indians prefer the traditional manner of sitting and working on the ground when packing parachutes.

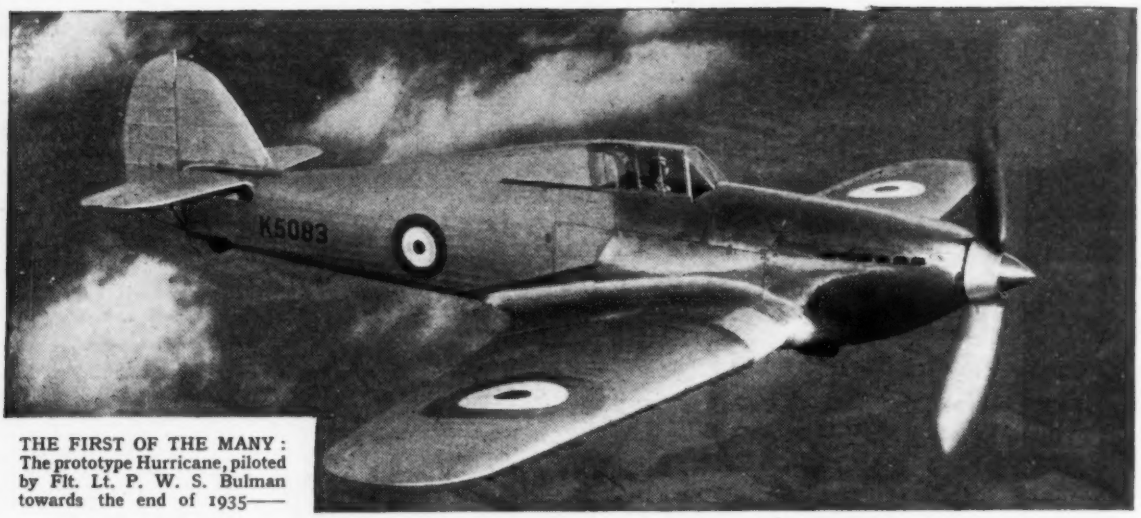
1. Tins of milk and bully beef being packed into light containers to save using up precious capacity on useless packing-cases.

2. A Wellington used by Transport Command in Burma.

4. The scene over the mountains which the pilots cross every day. Air is the only way.

7. A fully equipped Indian rifleman awaits his turn to emplane. He is equipped with the atest British rifle and bayonet.

8. A jeep is manhandled up the special ramps into a D.C. 3 for transportation to the forward areas.



THE FIRST OF THE MANY: The prototype Hurricane, piloted by Flt. Lt. P. W. S. Bulman towards the end of 1935——

The Last of the Many

Hawker Factory Delivers Hurricane 10,000 Plus: Born 1935 and Still Going Strong

THIS week marks the delivery of the last Hurricane from the production line of Hawker Aircraft, Ltd. At long last this old warrior, which first flew in November, 1935, must give way to faster and more powerful single-seater fighters, but this does not mean that the Hurricane is to be pensioned off and retired from service. Still far from being relegated to the past, the Hurricane is even now a first-line aircraft in several of the many different roles it has undertaken. As a close-support, low-attack fighter it is daily in action with the land forces in Normandy, Italy and Burma; as a fighter-bomber it carries two 500 lb. bombs; and as a rocket-firing cannon-fighter its fire power is equal to that of the Typhoon, the effect of which has been compared to a broadside from a cruiser.

Of all the 24 different battle fronts on which the Hurricane has seen action, its greatest achievement came in the Battle of Britain in 1940, when Hurricane squadrons formed the main equipment of Fighter Command, and Hurricane pilots shot down more than half the total number of enemy aircraft destroyed. Without detracting in any way from the magnificent courage, skill and endurance of the fighter pilots, the British victory was in some measure due to Hawker's who produced the aircraft in time and in sufficient numbers to enable the pilots to turn the day.

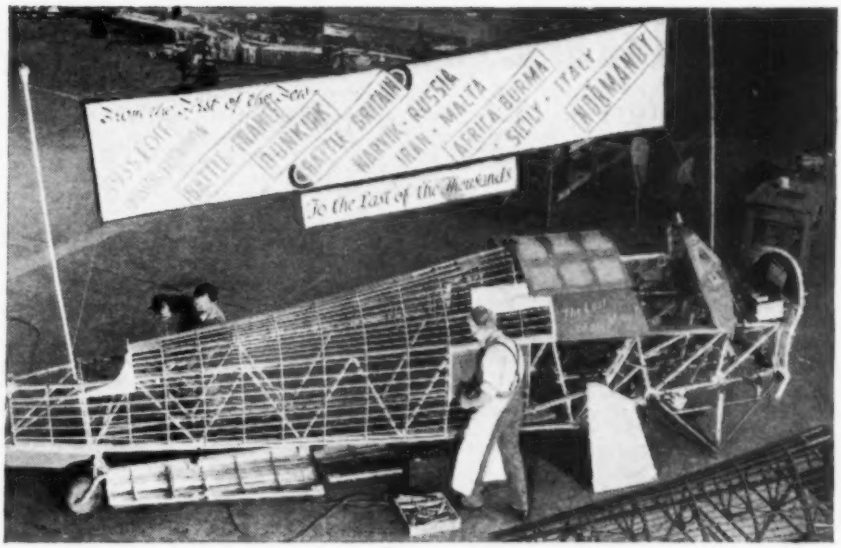
To no less a degree, Hurricane pilots were responsible for beating back the onslaught of the combined *Luftwaffe* and *Regia Aeronautica* on Malta. When the position with regard to shipping losses was at its blackest, Hurricanes hastily fitted with catapult gear were mounted on merchant ships and were launched against enemy bombers

——AND THE LAST: No more Hurricanes will be turned out by the Hawker factory. The pilot is Group Capt. P. W. S. Bulman.

THE LAST OF THE MANY

which came out to raid the convoys. In the North African campaign Hurricanes played a leading part throughout, and towards the end the R.A.F. sprang a surprise with the Hurricane IID tank-buster armed with two 40-mm. high-velocity guns, which played havoc with enemy armour.

Of the total number of Hurricanes produced, which, by the way, is well over the 10,000 mark, a considerable proportion has been sent to the U.S.S.R., where the Russians, like ourselves, found that in the hands of skilful pilots the machine was more than a match for German fighters on account of its high degree of manœuvrability and powerful armament.



Hawker workers were somewhat sad at the thought of starting on their last Hurricane. The banner explains some of the reasons for their affection for the old war horse.

The first rocket projectiles to be fitted to a single-seater fighter were installed on a Hurricane, and on September 2nd, 1943, the first rocket attack by a squadron of Hurricanes was made on the dock gates of the Landweert Canal in Holland with results that were comparable to those of the Möhne Dam attack.

During the war, the Hurricane has proved itself in all theatres of action from the Arctic Circle to the Equator, from France to Burma and Ceylon, and back to France again. It has operated where no other fighter could go, from landing strips that have been little more than mud-patches, from snowfields, from desert sand. All credit is due to the ground crews who have kept them flying under these conditions; they appeared to achieve the impossible, and if the machines had not been Hurricanes it would have been impossible.

The versatility of the Hurricane has never been surpassed by any other aircraft—one expert puts the number of variants at 163; although in reality this figure includes all the possible permutations and combinations of some twenty or thirty basically differing types. This versatility, combined with its high performance and fine flying qualities, together with the unyielding courage and tenacity of the fighter pilots, has made the Hurricane one of the most outstanding machines in the history of aviation.

FOUR AUSTERS PREVENT A CATASTROPHE

When R.A.F. Heavy Bombers Mistake Their Target in Normandy

THANKS to the promptness and courage of four A.O.P. Auster pilots, Allied ground forces on the Falaise front in Normandy were saved from being bombed by our own Lancasters and Halifaxes one day last week, when it suddenly became apparent that the R.A.F. bombers had mistaken their intended target. The four pilots who prevented this catastrophe were Capt. B. Halsey, of Hemel Hempstead; Capt. G. H. Piddock, of Birmingham; Capt. K. Spiller, of Taunton; and Capt. R. C. Hughes, of Chester. The first three of these are in the adjacent photograph (left to right) taken on the day of their adventure.

Available accounts of the incident are somewhat vague, but it seems that, through an error in identifying a wood, our forward troops were seen to be in imminent peril of receiving the hammering intended for some German panzers near by. A number of Lancasters had already released their bombs when the four little Austers immediately made for the spot and, bumping violently above the billowing black smoke, let off their Verey light signals to turn the bombers away. Flying through the murk between the bombers and their mistaken target, the risk those four pilots took needs no elaboration. But their signals were seen and disaster averted.

Endurance and Range

An Elementary Outline of How a Pilot Can, by Simple Means, Make Allowances for Wind Strength and Direction

By A. SIPOWICS, Squadron Leader, Polish Air Force

ANY pilot, particularly a military one, sooner or later comes across the problems of aircraft range and/or endurance. Range is the distance that can be flown; endurance the possible time of flight with a given amount of fuel.

The endurance of an aircraft depends only on the time rate of the fuel consumption and is, therefore, determined by the minimum power required for level flight. Wind has no effect on endurance except in so far as flying becomes more difficult if the air is bumpy. Flying on weak mixture with the lower ratio of the supercharger, with as much reduced r.p.m. and boost as possible gives the maximum endurance. The corresponding speed is called "the minimum-power speed." At this speed consumption is lowest and endurance reaches its maximum. It may be mentioned that low-altitude flying is advantageous for maximum endurance because less power is required to sustain an aircraft in denser air.

The minimum-power speed as a rule is only 25 per cent.-35 per cent. above the stalling speed of an aircraft. It is easily found by trial and error, keeping in level flight with the least boost and r.p.m. The pilot has, however, to choose between two possibilities: either less boost and higher r.p.m. or lower r.p.m. and greater boost. These alternatives as a rule do not give the same power for the same speed because the efficiency of the airscrew is different in the two cases.

Power developed by an engine is proportional to the product of the absolute pressure of the mixture and r.p.m. of the engine. Zero boost corresponds to 14.7 lb./sq. in. absolute pressure; any negative or positive boost correspondingly changes this value. Let us denote

Absolute pressure by	p
Boost pressure by	b
Revolutions per min. by	n
Power developed by	h.p.

Then $p = 14.7 \pm b$; and $h.p. = a.p.n$

where a is a coefficient of proportionality.

It is the task of the pilot in determining the minimum-power speed to find out the combination of boost and r.p.m. which gives the least value for h.p. in level flight. This combination varies with altitude, so it is recommended to find out the three best combinations: for low, medium and high-altitude flight.

Range Problems

The problem of range is much more complicated. As we shall see later, the speed to be chosen varies to a very great extent in different conditions of flight, and it is too great a simplification to stick to one or two recommended economical speeds. A simple example will show how a single recommended value for economical cruising, put forward without any stipulations, may prove incorrect.

The reader may come across a recommendation to fly on a certain type of aircraft at 160 m.p.h., as being the best cruising speed. Let us assume that the aircraft flies against a wind of the same strength. It is obvious that the range of the aircraft in these conditions is zero, because its ground speed is zero. On the other hand, flying at top speed (320 m.p.h.) the aircraft will have a considerable ground speed (160 m.p.h.) and a range of several hundred miles, corresponding to its endurance at full throttle.

Also a tail-wind obviously influences the range. It adds to the range in proportion to the time of flying, and a lower speed giving a greater endurance may prove advantageous. Thus in both cases is shown the important influence of wind on the speed to be chosen for getting maximum range.

The Vector Diagram

Before we begin to analyse this influence in detail, let us examine the terms "head-wind" and "tail-wind" as dealt with later in the article. A purely head- or tail-wind is rarely encountered. Usually a pilot must cope with more or less a side-wind, and therefore it is necessary to know how a side-wind may be replaced in our considerations by a head- or tail-wind of the strength equivalent in results to the existing side-wind. For readers who have forgotten this elementary navigational problem Fig. 1 shows how it is done.

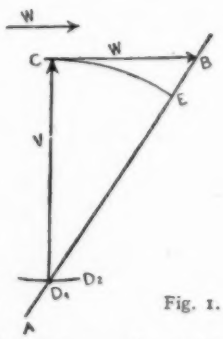


Fig. 1.

Let us assume that the proposed flight covers the distance AB and during the flight a side-wind of strength "w" prevails. We represent the speeds of the aircraft and of the wind by vectors or lines, the lengths of which are proportional to their values, and the directions conform to actual directions. Let us transfer the vector w so that its arrow-head coincides with the point of destination B. From the other end of w let us describe an arc, D_1-D_2, of a radius equal to the airspeed of the aircraft V, so that it cuts the line AB and the point D_1. Let us imagine that the aircraft takes off at D_1 and flies one hour in the direction D_1C. With no wind it would reach the point C. With the wind w it would be shifted to the point B. The ground speed of the aircraft is then represented by the line D_1B. From the figure we see that the wind w increases the ground speed by EB and this represents the equivalent strength of a tail-wind.

Wind and Range

We will now consider only head- or tail-winds and examine in detail their influence on range. As in most aeronautical questions, an experimental determination of range is less troublesome, quicker and more accurate than intricate theoretical considerations. Every pilot who wants to determine the range of his particular aircraft in various conditions of flight can do it without difficulty in the following way:

The pilot records in level flight at a chosen altitude the values of the corresponding factors:—

1, Airspeed. 2, Rev. per min. 3, Boost pressure. 4. Altitude. The last three factors determine the power output of the engine in these conditions and thus the rate of its fuel consumption. For determination of range, only the rate of fuel consumption and the airspeed are necessary, but a direct measurement of that rate in flight is rather difficult in an ordinary aircraft not provided with a precision fuel-consumption rate meter. The indirect way of determining the fuel-consumption rate is to refer to the engine power graphs, or performance curves, supplied on demand by the engine manufacturers. These graphs show the power developed in given conditions—r.p.m., boost and altitude, as well as the corresponding fuel-consumption rate. If we know the quantity of fuel (F) taken for the flight and the hourly consumption of it (f) at the relevant

ENDURANCE AND RANGE

speed (V) the endurance is determined by the equation

$$T = \frac{F}{f}$$

the relevant range without wind

$$R = TV = \frac{F}{f}V$$

or if a tail-wind + W or head-wind − W prevails

$$R = \frac{F}{f}(V \pm W)$$

Thus the ordinary procedure in determining an aircraft's endurance and range is as follows:

1. In level flight at a desired altitude record readings of the airspeed-indicator, revolution-counter and boost pressure gauge for several airspeeds.
2. Convert indicated airspeeds into true airspeeds.
3. From the manufacturer's engine-power graph find out the power developed and the fuel-consumption rate at each recorded airspeed.
4. Calculate endurance and range by the formulæ given above for each recorded airspeed and several conveniently chosen winds.
5. Complete a table like that given below and draw a corresponding diagram like the one in Fig. 2.

The table has been prepared for a twin-engined aircraft. The experimental flight was made at 1,000 feet altitude with 750 gallons of fuel. Fig. 2 represents graphically the interconnection between true airspeed and range according to the relevant values of the previous table. Each curve of the figure represents such an interconnection for a certain wind. The strength of the relevant wind is shown at the beginning of the curve by an equation, e.g., W = −30, i.e., with a head-wind of 30 m.p.h.

A set of curves similar to that in Fig. 2 may be worked out for any aircraft. A closer examination of such a set of curves shows many interesting and important details common to all aircraft.

All curves begin at a speed corresponding to the minimum-power speed of the aircraft. At this speed the still-air range is slightly less than a possible maximum. The maximum range may be reached only at a speed some 10 per cent. greater than the minimum-power speed. The

DATA CONCERNING ENDURANCE AND RANGE OF THE AIRCRAFT X AT 1,000 FEET ALTITUDE

From the Experimental Flight.

I.A.S. (m.p.h.) ..	118	128	148	178	227
Boost (lb./sq. in.)	−4	−2	0	+2	+6
R.P.M.	1,900	2,000	2,000	2,200	2,400
True airspeed (m.p.h.) ..	120	130	150	180	230

From the manufacturer's engine power graph

H.P.	2×480	2×510	2×690	2×950	2×1260
Fuel consumption rate f. (gal./hr.)	2×31	2×33	2×40	2×56	2×120
Endurance $T = \frac{F}{f}$ ..	12.1	11.4	9.45	6.8	3.12
Still-air range R = TV ..	1,450	1,480	1,420	1,220	720
With wind R = T(V±W)					
W = + 10 m/h	1,571	1,594	1,515	1,288	751
W = + 30 m/h	1,813	1,822	1,705	1,424	813
W = + 60 m/h	2,176	2,164	1,990	1,628	906
W = − 10 m/h	1,329	1,366	1,325	1,152	689
W = − 30 m/h	1,087	1,138	1,135	1,016	627
W = − 60 m/h	724	796	840	812	534

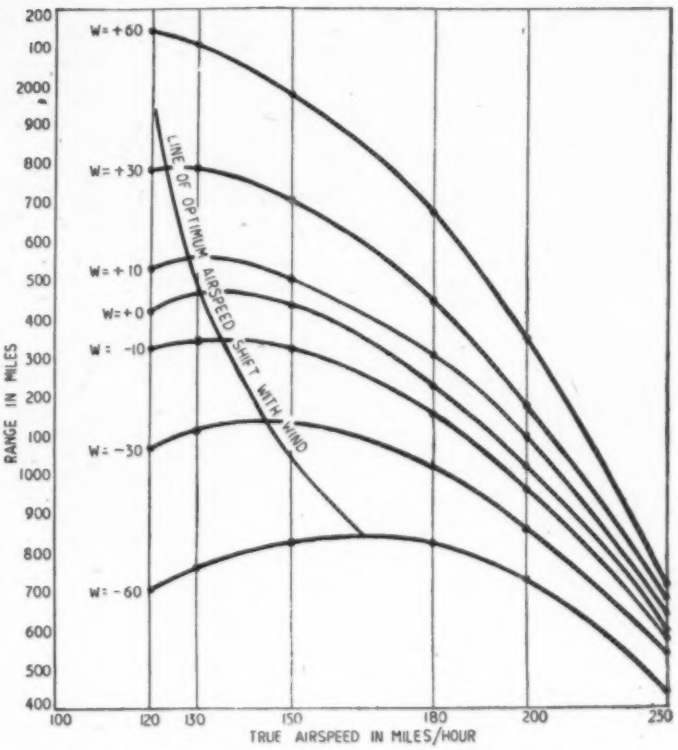


Fig. 2. Relationship between range and true airspeed.

speed corresponding to the maximum range is called the "optimum speed." *The optimum speed is equal to the best climbing speed if there is no wind during flight.* Theoretically it may be proved that it is the speed corresponding to the maximum value of the Lift/Drag ratio. The obvious difference in flying conditions is that less opening of the throttle is needed for level flight than for climbing at the same air speed.

Effect of Flying Too Fast

The range at speeds greater than the optimum decreases, the decrease becoming more and more marked with the increase of speed. A small increase against the optimum speed (say 10 per cent.) does not appreciably lessen the range, but it shortens the time of flight. Because of that a higher speed than the climbing speed is sometimes recommended for cruising. When, however, time is unimportant and there is no wind the optimum (climbing) speed should be chosen. A lower speed lessens the wear of the aircraft and makes it more reliable even after long service. The only economical justification for an increased speed is a head-wind. Examining the curves for head-winds, 10, 30 and 60 miles strong, we see that the maximum range shifts more and more to some higher speed. Thus for a head-wind of 60 m.p.h. the optimum flying speed is 160 m.p.h. as compared with 130 m.p.h. in still air.

For tail-winds the optimum speed shifts to lower speeds. This shifting may be continued only to the minimum power speed, which gives the maximum endurance and the greatest additional distance due to the effect of the wind.

The line of shift is not straight, and that means that with stronger head-winds it is necessary to increase the air speed more than proportionally. If the wind is not stronger than 25 per cent. optimum (climbing) speed the increase is fairly proportional and a rule good enough for practical purposes is to add or subtract one-quarter of the wind strength to the optimum still air speed.

For a stronger head-wind add the same percentage of its strength to the optimum (climbing) speed as the wind itself

ENDURANCE AND RANGE

is in the relation to that speed. For the example represented in Fig. 2, a wind of 60 m.p.h. is 46 per cent. of the optimum climbing speed (130 m.p.h.) $0.46 \times 130 = 35$; $130 + 35 = 165$ m.p.h., which fairly well corresponds to the optimum speed for that wind on the graph.

When making experiments the pilot must remember that the air speed determines the range only when the weight of the aircraft remains unchanged. The most favourable conditions for attaining the greatest possible range depend primarily on the choice of the optimum angle of incidence. If we want to fly level at a lower speed we must increase the angle of incidence and vice versa. If, however, the weight is increased, then at the same angle of incidence the speed must be increased, otherwise the aircraft begins to descend, increasing the angle automatically.

Thus air speed is a good indicator of the angle of incidence, so long as the weight of the aircraft remains unchanged. The optimum speed for the same aircraft, but with different loads, is different. It is easy to prove that retaining in all circumstances the best angle of incidence requires a change of speed according to the ratio

$$\frac{V_1}{V_2} = \sqrt{\frac{G_1}{G_2}}$$

Here V_1 and V_2 are the indicated air speeds. G_1 and G_2—weights. This simplifies the question of how to find the optimum speed if the weight of an aircraft is changed. In an aircraft the loads carried do not as a rule make any considerable change in the total weight. Bearing this in mind, it will be found that a simple and quite accurate approximation for practical purposes may be arrived at by calculating the required speed as follows:—

If the weight of an aircraft increases X per cent. then it is necessary to increase the speed $\frac{1}{2}$ X per cent. In the same way a decrease in weight of X per cent. should be accompanied by a decrease in speed of $\frac{1}{2}$ X per cent.

This shows the reader why a lower speed is always recommended on the return journey. When flying with a lesser load the speed should be lower in all circumstances—climbing, cruising or turning—if the pilot intends to fly always with the greatest possible efficiency.

It may be mentioned that a more heavily loaded aircraft has a diminished range. This is evident from the fact that a greater weight requires a greater speed at the same angle of incidence. The power required for an increased speed at the same angle of incidence increases much more rapidly than the speed itself (in proportion to the third power of speed). Corresponding to the increase in power, the range is diminished.

Lastly, when trying to get maximum range in given conditions, a pilot must remember the possibility of exploiting a favourable wind. Winds of different directions and strengths blow at the same time at different altitudes, and it is obviously advantageous to fly with a favourable wind. No one has ever seen migratory birds bound on long journeys flying against the wind. They always choose the time and altitude at which favourable winds help them to cover long distances. If operational necessities do not require otherwise, every pilot should follow their example.

CYCLONES NEW FINS

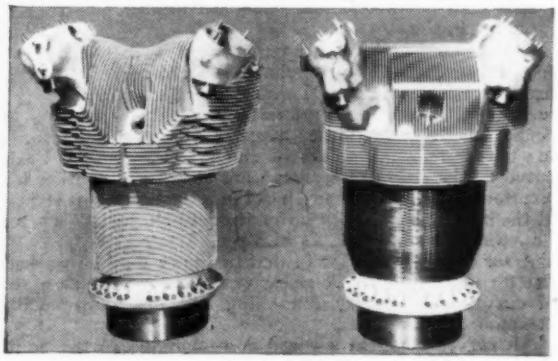
A NEW engineering design which will permit greater horse-power output of air-cooled aircraft engines and which will also save 24,000,000lb. of highly critical alloy steel per year has been announced by the Wright Aeronautical Corporation.

Developed in co-operation with Wilhelm B. Bronander, of the Scandia Manufacturing Company, of Arlington, New Jersey, the new design makes possible the use of aluminium cooling fins on steel cylinder barrels, with the steel-aluminium combination giving almost twice the cooling area of the all-steel fins. Sixty fins can be mounted on a barrel in the same space formerly required for 40 steel fins machined from the barrel wall. The increased cooling area, coupled with the fact that aluminium can dissipate heat more rapidly than steel, results in cooler operation, and in turn permits more power to be taken from the engine. It is particularly important on military aircraft, where sustained operation is frequently required at high percentages of power. The improved cooling also results in longer life for piston rings.

Formerly, cylinder barrel fins were machined by cutting 40 narrow grooves, each five-eighths of an inch deep, into a solid steel barrel with a wall three-quarters of an inch thick. This machining reduced the actual thickness of the cylinder wall to one-eighth of an inch and also left standing on the barrel 40 fins, each fin with a thickness of only 25 thousandths of an inch.

The new fin, known as the "W" fin, eliminates this difficult machining operation. The "W" fin is produced by folding a strip of sheet aluminium into the form of an extremely exaggerated letter "W," with the two outside legs one inch high and the centre portion only one-eighth of an inch in height. These strips are cut to size, shaped into half-circles and then snapped into shallow dovetail grooves cut into the barrel. A special tool then rolls over the short centre section of the "W," flattening this section and wedging the outside legs of the "W" into the dovetail grooves. This wedging not only holds the fin firmly in place but also provides a broad contact area through which heat can pass from the steel wall of the barrel into the aluminium fin. The aluminium fins can be made to almost any desired height, while the steel fins had virtually reached the maximum depth to which they could be cut in quantity production.

While this new barrel does not materially affect the over-all weight of the engine, the saving being only one pound per cylinder, there is a very important saving in the quantity of raw material required, the rough forging for the new barrel being substantially lighter than that for the older model. In one year's production of Cyclones, this saving will amount to 24,000,000lb.



The old Cyclone cylinder (left) and the new.

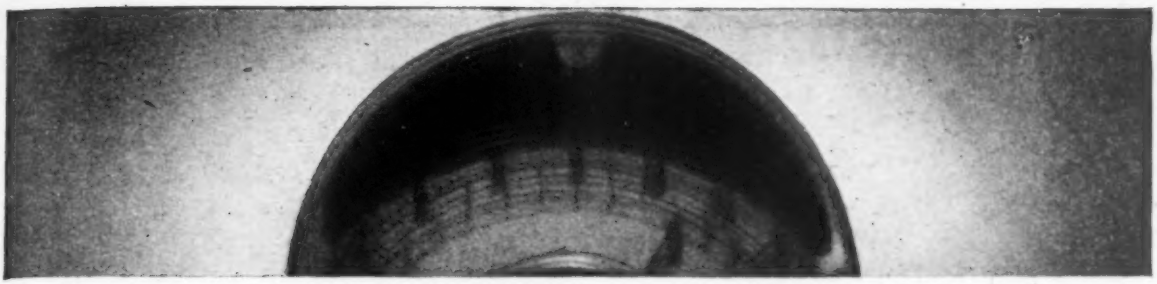
QUICK WORK BY R.N.Z.A.F.

THE assembling line method has been adopted at the R.N.Z.A.F. engine repair depot in the Waikato district for engine overhauls. This method has been such a success that the time for stripping, overhauling, and reassembling aircraft engines has been cut to less than half what it was under the old system. Even in the United States the times set by the R.N.Z.A.F. engine repair section have not been bettered.

A.T.A. BENEVOLENT FUND

WE are pleased to record the receipt of contributions amounting to £168 10s. to the above fund since our last statement appeared in the issue of May 25th. These bring the total of outside contributions to August 14th to £9,892 17s. 1d.

Already acknowledged	£9,724	7	1
Subscriptions by A.T.A. and B.O.A.C. members	4,102	1	6
Dunlop Rubber Co., Ltd	105	0	0
Ropey Old Pilots' Association	50	0	0
Flt. Lt. J. Mill, R.A.F., Ceylon	5	5	0
Sqn. Ldr. G. T. Stoneham, R.A.F.	5	0	0
Mrs. Hawkins, Hartley Wintney	2	0	0
Anonymous (May 19th)		10	0
Anonymous (July 6th)		10	0
Miss J. M. Smith, Aldershot		5	0
	£13,994	18	7



VIBRATION **destroys** ACCURACY

Delicate pivots,

fine gearing, tiny links and other details of sensitive instruments are damaged by vibration. Sometimes the damage is not instantly destructive, but is in the form of accelerated wear which sets up extra friction, impairs accuracy, and reduces the value and reliability of the readings obtained.

The importance of providing adequate vibration-absorbing mountings for aircraft instruments is well understood—for these are among the very many thousands for which we design and supply Metalastik mountings.

But in the factory and the power-station, the effects of vibration are not so fully realised, perhaps because they are not so obvious—but serious harm often results.

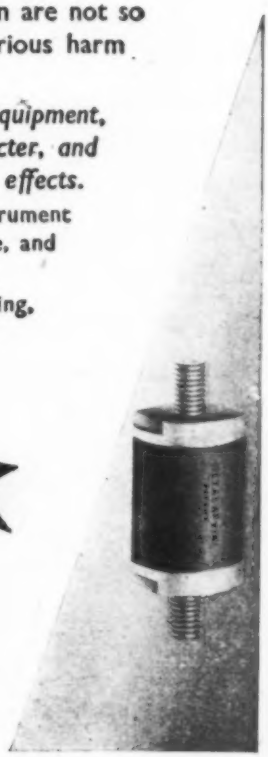
We in this company maintain a full research staff, with complete equipment, who can analyse vibrations from any source and of any character, and can design mountings to reduce or eliminate their harmful effects.

The small illustrations show three extremely simple Metalastik instrument mountings, the low-frequency type, left, the cross-type, centre, and the stud-type right.

An important development, the Statostable system of mounting, will be shown in a later advertisement.

Metalastik Ltd., Leicester.

METALASTIK



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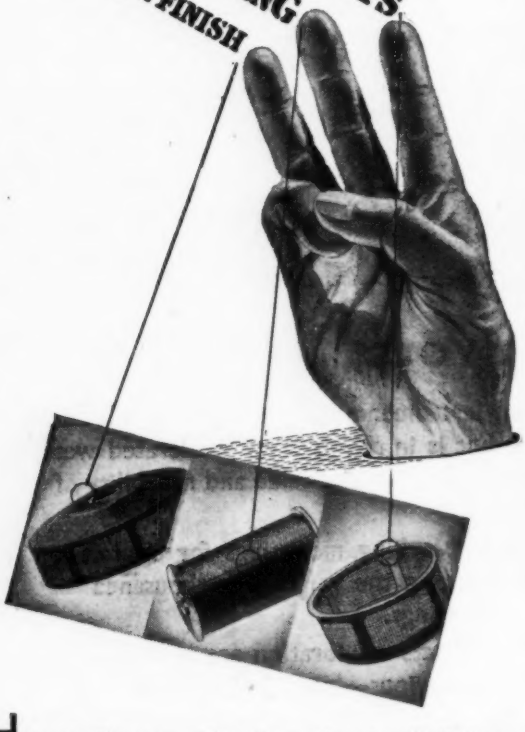

Here are three examples of our almost unlimited range of filter elements—fine filters, coarse filters—big filters, little filters—filters for all kinds of duties—we make them all. These filter elements have these great advantages over ordinary products—there are no soldered joints, the gauze has flawless metallic seaming and each one has press tool finish ensuring the highest degree of accuracy.

If you have any enquiries to make about filter elements just get in touch with us at Slough. Our design and development offices are at your service.—Telephone: Slough 22373/4

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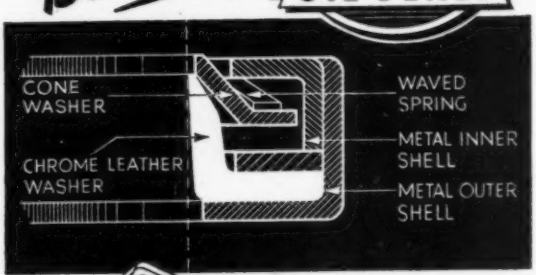

TO protect your Bearings at high and low speeds, use Gits Precision Oil Seals. They are made to seal ball, roller and plain sleeve bearings. They keep dirt, water, grit and foreign matter out, and prevent oil or grease leakage with little frictional loss. Oil is retained when the shaft is both stationary and rotating.

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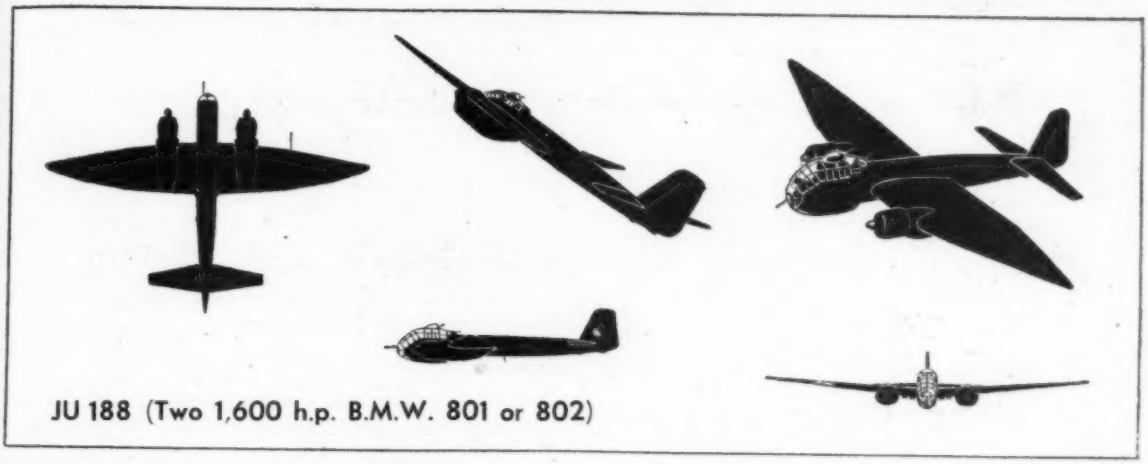
Studies in Recognition

Aircraft in Flying Attitudes

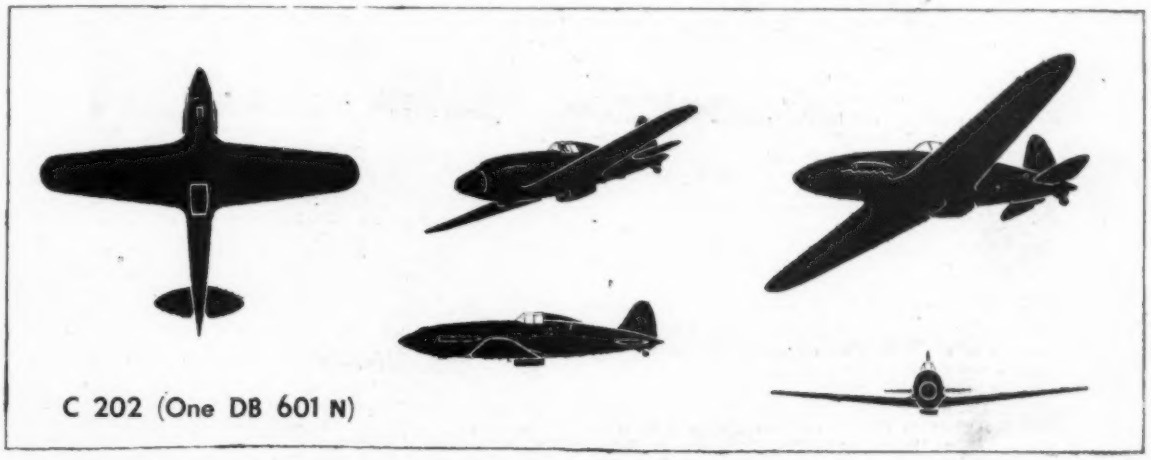


JU 188 (Two 1,600 h.p. B.M.W. 801 or 802)

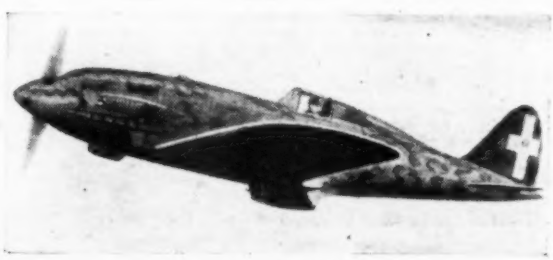
A DEVELOPMENT of the basic Ju 88 series of day and night fighters and fighter bombers, the Junkers Ju 188 is a medium bomber armed with a 20 mm. cannon in the nose, two dorsal 13 mm. machine guns and two 7.9 machine guns in the ventral position. It is powered by a pair of 1,600 h.p. B.M.W. 801 or 802 radial engines in contrast with the in-line Jumo engines with circular nose radiators characteristic of the Ju 88. Its top speed is about 290 m.p.h., and it was the chief type used in the "second blitz" on London earlier this year. It has latterly appeared in small numbers in Normandy.

Besides its more powerful radial engines, the Ju 188 differs from the Ju 88 in its increased span with pointed wing tips, redesigned nose which is completely glazed and better streamlined, and a more angular fin and rudder. Dimensions: Span 72ft. 6in., length 50ft.

Junkers Ju 188 Medium Bomber.



C 202 (One DB 601 N)



Macchi C202 Fighter.

JUST as the Spitfire had its ancestry in the Schneider Trophy seaplane so the Macchi C 202 is a military descendant of the Macchi Castoldi racing machine. It is structurally similar to its immediate predecessor, the C 200, but has a Mercedes-Benz DB 601N liquid-cooled, in-line engine instead of a Fiat air-cooled radial. But it in no way compares with the Spitfire in the important matter of performance, for its top speed is no better than 355 m.p.h. Some C 202s are now operating in Italy on both sides, whilst at least one squadron of a still later development, the C 205 with DB 605 engine, is reported to be in "co-belligerent" service against the German and Fascist enemy.

Aft of the long pointed nose, the fuselage, wings and tail unit are the same as those of the C 200 except for a modified cockpit cover. Dimensions: Span 35ft., length 29ft. 6in.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

"PENNIES FOR PLANES"

An Appeal by Air-Comdr. Sir Adrian Chamier

MAY I, on behalf of the Air League, ask for the courtesy of your columns to persuade your readers and their friends to take part in a great national scheme of Pennies for Planes?

When you hear planes in the air to-day, remember that you owe your freedom to British aviation. To remind you of that debt look up and once, on every day that you see a plane (or many planes) in the sky, say "Thank you."

At the same time, transfer a penny from your money pocket to another unusual pocket—or if you are a lady, from your purse to a corner of your bag. You have paid your debt for the day. In the evening when you turn out your pockets or bag you will find this lone penny in an unusual place; put it in a match-box on your mantelpiece. Don't hoard your pennies; change them for a sixpence or a shilling as they collect.

When you have half a crown take it to your local branch of the Air League or send it by postal order (crossed) to the Air League, 1a, Pall Mall East, London, S.W.1.

Your money will be used to help thousands of young people to learn to fly, and many hundreds of older people to experience the convenience of air travel at home or to Empire destinations. In this way we shall stimulate an industry which will give employment to thousands of gallant airmen who are fighting for us to-day.

J. A. CHAMIER.

IDLEWILD AIRPORT

Disposition of Runways

I WOULD like, rather belatedly, to ask a question in connection with the most interesting layout and article on Idlewild airport in your issue of July 6th.

Using the five E-W runways, saturation is estimated at 360 movements an hour, which implies good weather rather than bad visibility conditions.

But what happens when, owing to a change in wind, *some* aircraft have to use one of the long diagonals? It seems that either some aircraft will operate diagonally to others, or that all aircraft will be concentrated on to one runway. Neither alternative would seem satisfactory, as the one suggests danger and the other acute congestion, even if only for one day in the year.

I feel that there must be an obvious answer which I have missed, because the point is of radical importance in the basic layout of all major airports. For balanced saturation I should have thought that an equal number of runways must be provided in all essential directions, except that this number may be increased in the direction or directions used under bad visibility. In other words, the number of runways to be provided in a particular direction is not dependent on the wind-rose at all. Either there should be none, or there should be the appropriate number to give balanced saturation during every day in the year.

GRAHAM DAWBARN.

JET PROPULSION FOR AIRCRAFT

Balanced Pressure and Gas Velocity

AS I have only now got hold of a copy of *Flight* for July 20th, may I reply, rather late, to Mr. E. Burke?

Without getting down to molecular motions (though gas pressure *is*, of course, produced by random molecular motions), but regarding the gases in the jet tube as simply a mass of matter, I maintain that the inertia of that mass—its resistance to being accelerated astern—is the only "force" that can possibly balance that part of the internal pressure which is left "unbalanced" due to the existence of the open jet hole. The driving thrust, then, is impeller-pressure x area of jet. (The furnace is simply a volume multiplier.) And this thrust must be equal to P in the formula $P = mf$, where m is the mass being accelerated and f the acceleration.

I have tried, with inadequate data about temperature, pressure gradient, etc., to estimate acceleration, and velocity after acceleration, along a reasonable length of tube, and have come to the conclusion that I was wrong in saying that I should be surprised to find that velocity was not supersonic. It now appears to me that quite a good thrust can be got *without* supersonic velocity. Nevertheless, I feel that some qualification must be needed to the statement that sound-velocity is the greatest *possible* for gases emerging from a tube. What about gases from a gun? Do they move slower than the projectile?

My doubt about thrust augmentors was not whether they were worth while—admittedly they are not—but whether, in theory, they ought to be.

By entraining air during the process of acceleration we increase m but diminish f. And any transfer of velocity from one body to another necessarily involves loss. Our object in a jet is to get the emergence-pressure as low as possible, which implies getting the velocity as high as possible. And entrainment of air inside the tube is clearly not compatible with that object. So that it appears that the only time when a thrust-augmentor *might* be useful is when emergence-velocity would otherwise be supersonic—supersonic to what, by the way, the aircraft or the outside air?

L. SHELFORD BIDWELL.

POST-WAR A.T.C.

Already Working on "Empire" Lines

YOUR correspondent "Flying Citizen," in suggesting that the post-war A.T.C. might be established "as a truly Empire Youth Service in which young men of all the Dominions, Colonies, etc., could take part . . . even in the remotest corners of the Empire" is thinking on much the same lines as those on which the Corps is already working.

Almost all of the self-governing Dominions, also India, already have their own Air Training Corps (or an equivalent), in most cases closely identified with their own Air Forces, and the several Corps are all enthusiastic about a close and friendly co-operation. A recent development is an exchange of news about A.T.C. and other air activities throughout the British Commonwealth.

For its own part the A.T.C. is determined to do what it can within its field to make its own cadets "Empire Air conscious"—if the phrase may be permitted. An exchange of cadets, possibly on an Empire Air Scholarship basis, is one of the possibilities of the post-war A.T.C.

Air Marshal Sir Leslie Gossage, Chief Commandant of the Corps, has recently urged every cadet to learn all he can about air developments in the Empire. "I believe," he said "that Britain's future greatness will depend very largely on our air communications with the rest of the British Commonwealth, and the use which the Empire makes of the great air power we have built up together."

W. STUART MASTERS.

WHERE IS THE *LUFTWAFFE*?

A Possible Explanation

RECENTLY a major topic of conversation has been "Where is the *Luftwaffe*?" I would like to put forward a suggestion as to the reason for its disappearance.

When the Germans attempted to evacuate their troops from around Stalingrad the only possible way to do so was by air. As the *Luftwaffe* was short of transport aircraft, a large proportion of the available bomber force was transferred to the job of extricating what they could of the surrounded German army. These aircraft were so slaughtered by the Russian pursuit 'planes and ground defences that the *Luftwaffe's* bomber force was so reduced as to be almost negligible.

It was further depleted in Tunisia. In order to compensate for the loss in aircrews, the period of training was shortened. That was probably the reason why many of the German aircraft which attempted to raid London just before the introduction of the flying bomb did not press home their attacks, but jettisoned their bombs on meeting a heavy barrage.

The German fighter industry was almost destroyed by the persistent attacks of the British and American bombers, and, realising that it would be impossible to meet our onslaught by sheer weight of numbers, the Germans decided to concentrate on quality, as shown by the evolution of the Messerschmitt Me 163 rocket-propelled fighter reported to be built on the revolutionary flying-wing principle. When (and if) our jet-propelled fighters join the battle our pronounced superiority in quality will once again become apparent.

Other suggestions as to why the *Luftwaffe* has not shown up in very large numbers may be put forward, but, as far as I can see, this is the most likely explanation.

R. E. GREGORY.

FLYING HIGH : Two Lancaster IIs, each powered with four Hercules engines, flying above the clouds.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

Promotions

GENERAL DUTIES BRANCH

Air Comdre. W. M. YOOL, C.B.E., is granted the rank of Act. Air Vice-Marshal. August 1st, 1944.

TECHNICAL BRANCH

Air Comdre. E. B. ADDISON, C.B.E., is granted the rank of Act. Air Vice-Marshal. June 14th, 1944.

Awards

THE KING has been graciously pleased to give orders for the following appointments to the Most Honourable Order of the Bath in recognition of distinguished services in connection with the operations in Normandy :—

C.B. (Mil.)

Air Vice-Marshal H. S. P WALMSLEY, C.B.E., M.C., D.F.C., R.A.F.

Act. Air Vice-Marshal H. BROADHURST, D.S.O., D.F.C., A.F.C., R.A.F.

Act. Air Vice-Marshal S. C. STRAFFORD, C.B.E., D.F.C., R.A.F.

THE KING has been graciously pleased to give orders for the following promotion in, and appointment to, the Most Excellent Order of the British Empire in recognition of distinguished services in connection with the operations in Normandy :—

K.B.E. (Mil.)

Air Vice-Marshal B. E. BAKER, C.B., D.S.O., M.C., A.F.C., R.A.F.

C.B.E. (Mil.)

Air Vice-Marshal L. N. HOLLINGHURST, C.B., O.B.E., D.F.C., R.A.F.

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy :—

Second Bar to Distinguished Service Order

Act. Wing Cdr. J. R. D. BRAHAM, D.S.O., D.F.C., R.A.F.O.—Since being awarded a Bar to the D.S.O., this officer has taken part in many sorties, including numerous successful attacks on rail targets and on mechanical transport. In air fighting he has destroyed many more enemy aircraft, bringing his victories to at least 29. This officer has displayed the highest qualities of skill and leadership, and his achievements are a splendid testimony to his courage and fighting spirit.

Bar to Distinguished Service Order

Act. Wing Cdr. J. F. BARRON, D.S.O., D.F.C., D.F.M., R.N.Z.A.F., No. 7 Sqn.—One night in May, 1944, this officer participated in an attack on an airfield at Nantes. By his appreciation of the responsibilities entrusted to him and the skill and precision with which he executed his attack, Wing Cdr. Barron contributed in a large measure to the success achieved. Since being awarded the D.S.O., this officer has taken part in many attacks on dangerous and difficult targets. He is an outstanding captain whose example of skill, bravery and determination has impressed all.

Distinguished Service Order

Act. Wing Cdr. C. C. CALDER, D.F.C., R.A.F.V.R., No. 158 Sqn.—This officer has completed a second tour of operations, and has displayed the highest qualities of skill and gallantry throughout. He has displayed the greatest determination in pressing home his attacks and has achieved much success. On one occasion, in an operation against Frankfurt, two engines became unserviceable. In spite of this, Wing Cdr. Calder flew the aircraft back to this country after cleverly outmanœuvring a fighter which had closed in to attack. This officer is an efficient and forceful squadron commander, whose genius for leadership has contributed in good measure to the success of the formation he commands.

Act. Wing Cdr. G. H. GOODMAN, D.F.C., R.A.F.O., No. 151 Sqn.—This officer has commanded the squadron for many months with great success. He is a fine leader, whose ability and strong sense of duty have contributed materially to the great fighting spirit of the squadron. Wing Cdr. Goodman is a most tenacious fighter and has shot down at least nine enemy aircraft, three of them at night. He has set an example of the highest order.

Act. Sqn. Ldr. H. W. B. HENEY, R.N.Z.A.F., No. 582 Sqn.—This officer was the captain of an aircraft detailed to attack Dortmund on the night of May 22nd, 1944. When over the target area the aircraft caught fire, but Sqn. Ldr. Heney continued his bombing run. The flames reached dangerous proportions and became a target for the enemy's defences. Nevertheless, Sqn. Ldr. Heney made an effort to extinguish the flames, and, as they subsided, turned for home. One engine was useless, but he maintained a steady course, and later, although his aircraft sustained more damage in an attack by a fighter, he landed safely at base. This officer has participated in a large number of sorties and has displayed a

SUB. SINKERS : F/O. R. H. Mitchell (right) and Sgt. W. R. Stevenson, who have won the D.F.C. and D.F.M., respectively, for a successful attack on a U-boat in the Mediterranean.

SERVICE AVIATION

high degree of skill, courage and devotion to duty.

Act. Sqn. Ldr. S. L. SMART, D.F.C., R.A.F.V.R., No. 149 Sqn.—Since being awarded the D.F.C., this officer has participated in several sorties, and has continued to display the highest standard of skill, bravery and devotion to duty. During a recent operation his aircraft came under considerable light anti-aircraft fire, and was struck in the nose and in one of the engines; the rear turret was put out of action and other damage was sustained. In spite of great difficulty, Sqn. Ldr. Smart flew the damaged aircraft to base. His achievement was most commendable. This officer is a most inspiring leader, whose great zeal and fine fighting qualities have contributed in a large way to the success of the squadron.

Act. Sqn. Ldr. J. M. DENNIS, D.F.C., R.A.F.O., No. 7 Sqn.—One night in May, 1944, this officer captained one of a formation of aircraft detailed to attack the railway junction at Chambly. In the operation, Sqn. Ldr. Dennis displayed notable skill and, regardless of the enemy's defences, pressed home his attack with great accuracy. His brilliant work was a prominent factor in the great success achieved. This officer has taken part in a very large number of sorties and has set a rare example of skill, courage and devotion to duty.

Flt. Lt. W. E. M. EDDY, R.A.F.V.R., No. 103 Sqn.—In air operations this officer has displayed skill, courage and fortitude with the highest traditions of the Royal Air Force.

Act. Flt. Lt. C. S. CHATTEN, R.A.F.V.R., No. 97 Sqn.—One night in May, 1944, this officer was the pilot of an aircraft detailed to attack Brunswick. On the outward flight the aircraft was intercepted by a fighter but it was cleverly evaded. When nearing the target area, however, another fighter was encountered. As a result the bomber was severely damaged. The nose part was smashed. The air pressure thus caused blew out the windows at the side and most of the windscreen around the pilot's cupola. The navigational equipment, the wireless apparatus and the mid-upper turret were rendered useless, whilst two members of the crew were wounded. The cold was intense. Nevertheless, Flt. Lt. Chatten was determined to complete the task for which he had flown so far. In the face of much anti-aircraft fire and an attack by yet another fighter he executed a successful bombing run and afterwards flew the damaged aircraft back to this country. This officer displayed skill, gallantry and devotion to duty of the highest order.

F/O. P. G. WEST, R.A.F.V.R., No. 164 Sqn.—This officer was the pilot of one of a small formation of aircraft detailed to attack a ground target one morning in May, 1944. His objective was the destruction of a light gun position which menaced the success of the operation as a whole. In the execution of his task, F/O. West displayed such precision and resolution that the enemy gunners were unable to fire a single shell in defence of their position. His main task was accomplished but seeing the guns of another emplacement further west, F/O. West pressed home an attack on this position on which he expended the remainder of his ammunition. As he turned for home his aircraft was hit by a shell. F/O. West was severely wounded in the arm and leg, both limbs being rendered useless. His radio/telephone was put out of action. Nevertheless, this gallant pilot displayed the greatest coolness. With his good arm he lifted his maimed one above his head in an effort to decrease the flow of blood and set course for home. In this position he flew the aircraft to this country. Soon after crossing the coast he successfully effected a crash-landing in a field near the main road. This officer displayed courage, endurance and devotion to duty beyond praise.

Act. Flt. Lt. W. M. STEPHEN, R.C.A.F., 427 (R.C.A.F.) Sqn.—One night in May, 1944, this officer captained an aircraft detailed to attack Aachen. When crossing the enemy coast, the aircraft was hit by fire from the ground defences. The starboard rudder and the elevator controls were so badly damaged that the aircraft became unmanageable. Undaunted, Flt. Lt. Stephen went on to the target and bombed it. He afterwards flew the damaged aircraft to this country. Although the tailwheel had been shot away and the brake pressure was nil, Flt. Lt. Stephen effected a safe landing. His perseverance in the face of great odds, together with his exceptional skill and resource, set an example of a high order.

Bar to Distinguished Flying Cross

Act. Sqn. Ldr. J. E. MORPHETT, D.F.C., R.A.A.F., No. 355 Sqn.—This officer has taken part in many sorties and has set the highest example of skill, gallantry and devotion to duty, qualities which were amply demonstrated on a recent occasion. After attacking his target one engine of his aircraft failed, but he flew on to reach friendly territory. Trouble then developed in the three remaining engines, and Sqn. Ldr. Morphett realised he would not be able to reach base. He therefore requested his crew to leave by parachute. With complete disregard for his own welfare, he remained at the controls until he was satisfied that his comrades were clear. By now the aircraft was too low for a successful parachute descent, and Sqn. Ldr. Morphett attempted to effect a landing in the darkness. All the engines ceased to function, however, and as the bomber crashed, this gallant captain was seriously injured. Nevertheless, by his sacrifice and devotion to duty, he was undoubtedly responsible for the ultimate safety of his crew.

Act. Sqn. Ldr. W. N. WHAMOND, D.F.C., R.A.F.V.R., No. 619 Sqn.—One night in May, 1944, this officer piloted an aircraft detailed to attack a target at Salbris. Before reaching the objective the aircraft was hit by anti-aircraft fire an I one engine was rendered useless. This did not deter Sqn. Ldr. Whamond from continuing his mission and he went on to execute his attack. Since being awarded the D.F.C., this officer has participated in many sorties and has successfully attacked such targets as Berlin, Stuttgart and Brunswick. He has set a fine example of skill and gallantry throughout.

Act. Flt. Lt. J. A. HOWARD, D.F.C., R.A.F.V.R., No. 619 Sqn.—One night in May, 1944, this officer and airman were rear and mid-upper gunners respectively of an aircraft detailed to attack a target at Salbris. At the commencement of the bombing run, Flt. Sgt. Birch sighted a fighter coming in to attack. He promptly warned his co-gunner, Flt. Lt. Howard, who opened fire at long range to prevent the enemy aircraft from pressing home its attack until the target had been bombed. Afterwards, these gunners directed their pilot in the necessary combat manœuvres and the engagement was successfully terminated with the destruction of the attacker. This officer and airman displayed great skill, coolness and co-operation. Since being awarded the D.F.C., Flt. Lt. Howard has completed very many sorties and has invariably displayed praiseworthy gallantry and devotion to duty. Flt. Sgt. Birch, who has taken part in many missions, has also proved himself to be a courageous and dependable member of aircraft crew.

F/O. P. KELLY, D.F.C., R.A.F.V.R., No. 617 Sqn.—Since being awarded the D.F.C., this officer has completed very many sorties against dangerous and difficult targets. Throughout he has displayed navigational ability of the highest standard which has contributed in a large measure to the success obtained. On a recent occasion F/O. Kelly was the navigator of an aircraft which attacked Munich. In spite of heavy anti-aircraft fire and much searchlight activity, F/O. Kelly coolly and skilfully directed his captain to the precise target which was successfully attacked. This officer has invariably displayed a high degree of courage and his record is worthy of the greatest praise.

Flt. Lt. R. W. BRAY, D.F.C., R.A.F.V.R., No. 105 Sqn.—Since being awarded the D.F.C., this officer has completed very many sorties and has continued to display the highest standard of skill and resolution. One night in May, 1944, he piloted an aircraft detailed to attack Leverkusen. When approaching the target the aircraft was hit by anti-aircraft fire, causing damage to the port wing and engine nacelle. Considerable vibration ensued but, in spite of this, Flt. Lt. Bray executed an accurate attack. The vibration became so pronounced that it became necessary to put the affected engine out of action. Height was being gradually lost and the aircraft became extremely difficult to control, but Flt. Lt. Bray flew on to reach this country. His tenacity was typical of that he had shown throughout the many sorties in which he has taken part.

Distinguished Flying Cross

Act. Sqn. Ldr. S. L. COCKBAIN, R.A.F.V.R., No. 44 Sqn.
F/O. R. S. MALLETT R.A.F.V.R., No. 141 Sqn.
F/O. L. J. SUMPTER, D.F.M., R.A.F.V.R., No. 617 Sqn.
P/O. A. G. EDGAR, R.A.F.V.R., No. 49 Sqn.
Flt. Lt. K. J. NEWMAN, R.N.Z.A.F., No. 684 Sqn.
Act. Wing Cdr. R. A. MCLERNON, R.C.A.F., No. 425 (R.C.A.F.) Sqn.
Act. Flt. Lt. F. HART, R.A.F.V.R., No. 578 Sqn.
Act. Flt. Lt. C. G. FORD, R.C.A.F., No. 428 (R.C.A.F.) Sqn.
Act. Flt. Lt. R. H. V. HUNT, R.A.F.V.R., No. 429 (R.C.A.F.) Sqn.
Act. Flt. Lt. R. A. WESTELL, R.C.A.F., No. 428 (R.C.A.F.) Sqn.
F/O. B. D. ARDIS, R.C.A.F., No. 427 (R.C.A.F.) Sqn.
F/O. H. S. BOARDMAN, R.A.F.V.R., No. 153 Sqn.
F/O. F. C. BONE, R.A.F.V.R., No. 169 Sqn.
F/O. W. H. MILLER, R.A.F.V.R., No. 169 Sqn.
Flt. Lt. C. C. CUNNINGHAM, R.C.A.F., No. 162 Sqn.
F/O. D. A. DERBY, R.A.F.V.R., No. 39 Sqn.
F/O. M. C. SHERWOOD, R.C.A.F., No. 424 (R.C.A.F.) Sqn.
F/O. G. L. SPACKMAN, R.C.A.F., No. 424 (R.C.A.F.) Sqn.
F/O. H. S. REID, R.A.F.V.R., No. 144 Sqn.
P/O. L. D. COOPER, R.A.F.V.R., No. 144 Sqn.
Lt. V. J. ARNOLD, S.A.A.F., No. 12 (S.A.A.F.) Sqn.
P/O. R. A. GRAY, R.C.A.F., No. 158 Sqn.
P/O. E. A. LOGAN, R.C.A.F., No 432 (R.C.A.F.) Sqn.
W/O. J. J. B. G. LAPIERRE, R.C.A.F., No. 408 (R.C.A.F.) Sqn.
Act. Sqn. Ldr. E. SPRAWSON, R.A.F.O., No. 106 Sqn.
Flt. Lt. G. F. LAMBERT, R.A.F., No 35 Sqn.
Act. Flt. Lt. T. RAWLINSON, R.A.F.V.R., No. 429 (R.C.A.F.) Sqn.
F/O. W. G. BRASNETT, R.C.A.F., No. 415 (R.C.A.F.) Sqn.
F/O. T. H. PARNELL, R.A.F.V.R., No. 415 (R.C.A.F.) Sqn.
F/O. G. B. ELLIS, R.A.F.V.R., No. 76 Sqn.
P/O. S. E. CAMPBELL, R.C.A.F., No. 408 (R.C.A.F.) Sqn.
P/O. F. W. COLE, R.A.F.V.R., No. 76 Sqn.
P/O. J. C. STIRLING, R.A.F.V.R., No. 145 Sqn.
P/O. G. G. WHITEHEAD, R.A.F.V.R., No. 76 Sqn.
Act. Sqn. Ldr. J. D. THIRLWELL, R.A.F., No. 194 Sqn.
Flt. Lt. G. A. CHURCH, R.A.F.V.R., No. 228 Sqn.
Act. Flt. Lt. D. R. ALEXANDER, R.A.F.V.R., No. 35 Sqn.
Act. Flt. Lt. D. H. REID, R.A.F.V.R., No. 57 Sqn.
P/O. R. K. FRANCIS, R.A.F.V.R., No. 14 Sqn.
W/O. G. W. DARLING, No. 35 Sqn.
W/O. J. W. R. DODWELL, R.A.F.V.R., No. 357 Sqn.
F/O. E. S. MURPHY, R.A.A.F., No. 14 Sqn.
F/O. B. V. L. VEIRA, R.C.A.F., No. 12 Sqn.
P/O. H. A. JAMIESON, R.N.Z.A.F., No. 35 Sqn.
Maj. W. R. RHODES, S.A.A.F., No. 24 (S.A.A.F.) Sqn.
Capt. A. E. SHUTTLEWORTH, S.A.A.F., No. 24 (S.A.A.F.) Sqn.
Lt. I. A. SCOTT, S.A.A.F., No. 24 (S.A.A.F.) Sqn.
Wing Cdr. D. O. F. LUMSDEN, R.A.F., 144 Sqn.
Act. Flt. Lt. D. H. PHILLIPS, R.A.F.V.R., No. 102 Sqn.
F/O. T. T. SMART, R.A.F.V.R., No. 207 Sqn.
P/O. J. H. BOLFS, R.N.Z.A.F., No. 166 Sqn.
P/O. B. A. POTTS, R.A.A.F., No. 75 (N.Z.) Sqn.
P/O. B. E. WALKER, R.A.F.V.R., No. 57 Sqn.
F/O. H. F. E. SMITH, R.C.A.F., No. 419 (R.C.A.F.) Sqn.

THE KING has been graciously pleased to approve the following awards in recognition of gallant and distinguished services:—

Distinguished Flying Cross

Lt. (temp. Capt.) R. A. FORTNUM, Royal Regiment of Artillery.
Lt. (temp. Capt.) R. A. LLOYD, Royal Regiment of Artillery.

THIRTY YEARS AFTER: Marshal of the R.A.F., Lord Trenchard, talking to pilots of an Australian fighter squadron who had just returned from an attack on enemy motor transport.

FROM FITTER TO PADRE : Sqn. Ldr. The Rev. T. G. Perkins (centre) helping fitters to wheel out a Spitfire. At one time he was fitter to Air Marshal Sir Arthur Coningham, who is now his A.O.C.

Conspicuous Gallantry Medal (Flying)

Flt. Sgt. M. L. LANGLEY, R.N.Z.A.F., No. 489 (N.Z.) Sqn.—As pilot and navigator of aircraft respectively these airmen have participated in numerous attacks on enemy shipping and have set a fine example of skill and dash. In May, 1944, they took part in an attack on a heavily armed convoy and obtained a hit on one of the vessels. Flt. Sgt. Langley also used his machine guns to good effect on two minesweepers. Some days later these airmen were again in action against enemy shipping. At the outset of the flight, Flt. Sgt. Langley was wounded in the throat, arms and thigh. In spite of this he pressed home his attack and afterwards flew the aircraft to base. He displayed courage and fortitude of the highest order. Flt. Sgt. Parish also proved himself to be a cool and resolute member of aircraft crew. On the return flight he attended to his wounded pilot and did everything in his power to assist him in his endeavours to reach this country. He proved a tower of strength.

Distinguished Flying Medal

Flt. Sgt. L. J. BIRCH, R.A.A.F., No. 619 Sqn.—For citation see Act. Flt. Lt. HOWARD, D.F.C., and Bar.

Flt. Sgt. E. G. PARISH, R.A.F.V.R., No. 489 (N.Z.) Sqn.—For citation see Flt. Sgt. LANGLEY, C.G.M.

Sgt. J. W. CARRIGAN, R.A.F.V.R., No. 428 (R.C.A.F.) Sqn.

Flt. Sgt. H. L. GRAYSON, R.C.A.F., No. 403 (R.C.A.F.) Sqn.

Act. Flt. Sgt. T. A. LLOYD, R.A.F.V.R., No. 550 Sqn.

Sgt. R. L. G. MOORE, R.A.F.V.R., No. 550 Sqn.

Sgt. R. D. CHANDLER, R.A.F.V.R., No. 57 Sqn.

Sgt. D. H. WRIGHT, R.C.A.F., No. 432 (R.C.A.F.) Sqn.

Sgt. W. J. ZIMKO, R.C.A.F., No. 432 (R.C.A.F.) Sqn.

Flt. Sgt. R. K. SMITH, R.A.F.V.R., No. 684 Sqn.

Flt. Sgt. F. DAY, R.A.F.V.R., No. 418 (R.C.A.F.) Sqn.

Flt. Sgt. R. W. G. SULLIVAN, R.A.F.V.R., No. 419 (R.C.A.F.) Sqn

Sgt. J. M. A. CROTEAU, R.C.A.F., No. 425 (R.C.A.F.) Sqn.

Sgt. V. A. ROE, R.A.F.V.R., No. 35 Sqn.

Sgt. L. E. WESTBROOK, R.A.F.V.R., No. 218 Sqn.

Flt. Sgt. (now P/O.) L. W. G. HEAD, No. 12 Sqn.

Flt. Sgt. J. E. S. MATTHEWS, No. 35 Sqn.

Flt. Sgt. J. H. PRIOR, No. 49 Sqn.

Flt. Sgt. D. C. SMITH, R.A.F.V.R., No. 429 (R.C.A.F.) Sqn.

Flt. Sgt. D. A. WATKINS, No. 419 (R.C.A.F.) Sqn.

Sgt. H. G. CHUCK, No. 221 Sqn.

Sgt. J. N. COCKROFT, R.A.F.V.R., No. 38 Sqn.

Sgt. J. C. EVANS, No. 57 Sqn.

Sgt. A. J. KAPPLER, R.A.F.V.R., No. 177 Sqn.

Sgt. F. MELLOR, No. 111 Sqn.

Foreign Decorations

THE KING has granted unrestricted permission for the wearing of the undermentioned decorations conferred upon the officers indicated in recognition of valuable services rendered in connection with the war :—

Conferred by the President of the United States of America

Air Medal

Act. Air Vice-Marshal T. M. WILLIAMS, C.B., O.B.E., M.C., D.F.C., R.A.F.

Bronze Star Medal

Act. Flt. Lt. W. H. TURNER, R.A.F.V.R.

Conferred by His Majesty the King of Norway

St. Olav Medal with Oakleaves

Flt. Lt. N. D. MACKERTICH, D.F.C., R.A.F.V.R.

Roll of Honour

Casualty Communiqué No. 416.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties " in action " are due to flying operations against the enemy; " on active service " includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list, 100 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. R. A. Clothier; Sgt. C. Dickinson; Sgt. J. R. Haworth; Sgt. J. I. Jones; Sgt. J. L. Parry; F/O. A. O. Stafford; F/O. D. S. Turner.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. S. E. Baber; Flt. Sgt. J. H. Benny; Sgt. G. A. Bicknell; Sgt. R. G. Blood; Sgt. D. B. Bowen; Sgt. K. E. Bright; P/O. E. J. Brown; Sgt. J. S. Carmichael; Sgt. A. S. Carscadden; Sgt. R. T. Chinn; Sgt. R. M. Coles; Sgt. R. A. Cordell; Act. Flt. Lt. B. Cottrell; Sgt. J. Cowap; Flt. Sgt. A. R. Crowther; Sgt. P. T. Davies; Sgt. H. A. Eaton; Sgt. H. Fisher; Sgt. N. Fleming; Sqn. Ldr. K. J. Foster, D.F.C.; Sgt. L. C. Gay; Sgt. S. G. Gibbs; Flt. Sgt. J. R. Griffin; Sgt. S. J. Harris; Sgt. D. H. Hendry; Act. F/O. G. G. Hurst; Sgt. C. Jeffcock; Sgt. S. J. Jordan; P/O. G. A. Lawrenson; Sgt. J. McGovern; Sqn. Ldr. R. A. McKinna, D.F.C.; Sgt. J. G. Mein; Flt. Sgt. W. J. H. Menlove; Sgt. J. T. Millany; Flt. Lt. G. Newsham; Sgt. E. Otter; Flt. Sgt. E. Robinson; Sgt. W. L. Smith; Sgt. T. H. Sutton; Sgt. W. Thornhill; P/O. M. W. B. Walsh; Sgt. W. C. L. Wood; Sgt. R. C. Woolnough.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. D. Booth; F/O. G. Crabtree; Sgt. R. D. Hewlett; Sgt. J. W. Hoyle; F/O. J. Rigby; Sgt. M. J. Webber; Sgt. P. C. Wilson.

MISSING.—Flt. Sgt G. H. Agar, D.F.M.; P/O. R. C. Alexander; Sgt. D. G. Allen; Act. Flt. Lt. A. Amies; P/O. A. L. Anderson; F/O. J. E. J. Arscott; Sgt. H. S. Baker; Flt. Sgt. D. F. Ball Flt. Sgt. H. Barrett; Sgt. H. F. Benbow; Flt Sgt. P. Bissett; Flt. Sgt. J. E. Bloomer; Sgt. J. Booth; Flt. Sgt. J. S. Bradley; Sgt. K. W. Brown. Flt. Sgt. J. M. Buckley; Sgt. J. D. Cairns; Flt Sgt. R. Cairns; Sgt. J. W. Cameron; Sgt. R. M. Cartlidge; Flt Sgt. S. R. Chafer; Sgt. M. L. Chaundy; Flt. Sgt. G. E. Coe; Sgt. J. N. Craig; Sgt. L. Craven; Sgt. S. R. Crate; Sgt. G. P. Croad; Flt. Sgt. F. T. Cross; Flt. Sgt. R. D. Daniels; Flt. Sgt. W. G. Davis; P/O. J. R. Dickinson; Sgt. H. Dootson; Sgt. E. C. Duffy; Sgt. D. A. Eld; Sgt. J. Ellenor; Flt. Sgt. J. R. Elliott; Sgt. C. L. Finighan; Sgt. R. Fowls; Sgt. P. Freil; Act. Sqn. Ldr. F. E. Fuller; F/O. R. L. Gibson; Flt. Sgt. J. T. Gill; Wing Cdr. H. R. Goodman; F/O. A. Greenwood; Sgt. R. Guile; Sgt. D. V. Guttridge; Sgt. R. B. Hainsworth; Sgt. W. Hall; F/O. R. A. C. Hammond; Sgt. G. Hand; F/O. J. E. Hanks; Sgt. A. Hansford; P/O. D. E. D. Harvey; Sgt. W. J. Heward; Flt. Sgt. J. Hill; Sgt. F. W. Hinton; Sgt. R. S. Hollingum; Sgt. R. H. Hudson; Sqn. Ldr. C. H. Hunter; P/O. H. Ibbotson; Sgt. D. St. C. Ingram; P/O. A. T. Jackson; Sgt. R. N. Johnson; Flt. Sgt. E. T. Jones; Sgt. G. Jones; Act. Flt. Lt. L. C. Jones; Sgt. D. King; Sgt. S. Lee; Sgt. D. E. Lister; W/O. R. W. Long; Sgt. E. A. Louis; Sgt. W. H. Loverock; Flt. Sgt. J. J. Lovett; Sgt. A. J. McAllister; P/O. F. S. McFarlin; Sgt. B. McLeod; Sgt. P. G. Mellor; P/O. G. R. Miles; Sgt. A. R. Mitchell; Flt. Sgt. D. W. Muddiman; Sgt. H. E. F. Owen; Sgt. W. A. Palmer; P/O. J. G. Parker; Flt. Sgt. P. D. Parkes; Sgt. S. R. Patti; F/O. E. R. Penman; Flt. Sgt. J. A. Phillips; Flt. Sgt. F. J. Pinch; F/O. C. K. Plunkett; F/O. T. J. Pullin; Sgt. R. C. Reid; Flt. Sgt. W. H. Riding; Sgt. J. A. Roberts; Sgt. R. Roberts; Sgt. A. R. Rowlands; Sgt. E. W. Rushton; P/O. F. A. Salmon; Sgt. A. W. Seago; F/O. E. L. Sharp; P/O. W. M. Shaw; Flt. Lt. W. Sinclair; Sgt. C. W. F. Sizer; Sgt. A. Smith; Sgt. J. F. Smith; Sgt. R. J. Smith; Sgt. C. Stephenson; F/O. L. D. Steylaerts; P/O. H. A. Sutherland; Flt. Sgt. P. D. Sykes; Sgt. A. A. Taylor; Sgt. C. R. Todd; P/O. P. D. Vickers; Flt. Sgt. F. W. Wale; Sgt. B. H. Watts; F/O. A. W. Weston; Flt. Sgt. R. White; Sgt. D. J. Wilson; Sgt. G. Wood; Flt. Lt. P. W. H. F. Wood; Sgt. J. H. Woodcock.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—F/O. J. H. Corless; Flt. Sgt. K. Fawcett; P/O. D. S. Richards; Sgt. R. H. Walters.

KILLED ON ACTIVE SERVICE.—F/O. M. E. Heels.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. E. J. Aldridge.

PREVIOUSLY REPORTED WOUNDED OR INJURED ON ACTIVE SERVICE, NOW REPORTED DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. E. Bamford.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. S. C. Bowker; F/O. H. R. D. Budd; Act. Flt. Lt. E. Dampier-Crossley, D.F.C.; Flt. Sgt. F. S. Forsyth; Flt. Lt. K. G. Fry; Sgt. J. E. Fryer; Sgt. H. B. Lydeamore; P/O. J. D. W. Renno, D.F.M.; Sgt. R. S. Veale.

MISSING.—F/O. J. S. Braithwaite; P/O. E. R. Brown; Act. Flt Lt. W. McL. Chase; Flt. Sgt E. R. Clayworth; P/O. D. C. Crosthwaite; P/O. R. W. Jefferies; Flt. Sgt. G. H. Noakes; P/O. E. W. Page; Flt. Sgt. R. K. Watson; Flt. Sgt G. H. Williamson.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt E. J. Cooper; F/O. W. C. Ingraham.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. H. W. Cudney; F/O. D. W. Ditzler; Flt. Sgt. E. B. Donnelly; Sgt. H. L. Douglas; Flt. Sgt. R. G. Dunn; Sgt J. A. C. Dupont; P/O. R. F. Eberle; F/O. E. H. Erickson; Sgt. D. Everest; W/O. J. S. Ferris; Flt. Sgt. C. E. Flewin; Flt. Sgt. J. Galloway Sgt. M. E. Gee; Flt. Sgt. C. W. Gibbs; Sgn. Ldr F. E. Grant; Flt. Sgt. C. E. Hall; Sgt. R. S Hannah; Flt. Sgt. A. B. Jackson; F/O. G. D Kain; Flt. Sgt. E. Kelloway; Flt Sgt. G. McG King; F/O. H. A. N. Kitchen; Flt. Sgt. J McDonald; Sgt. W. F. MacKenna; Flt. Sgt. N. S McLeod; F/O. F. T. Manners; W/O G. T. Mutton; P/O. J. A. M. Nadeau; Sgt. H. Newlove Flt. Sgt. N. A. Noble; Flt. Sgt. C. F. Phillips F/O L. J. Roberts; Flt. Sgt. N. V. Spencer; Flt Sgt. A. D. Steadman; Flt. Sgt. J. H. Tovey; Flt Sgt. W. J. Whitney; Sgt. D. W. Wilson; Flt. Sgt D. MacK. Wylie.

MISSING, BELIEVED KILLED IN ACTION.—F/O D. G. Bentley; P/O. R. A. Booth; W/O. N. H. Clifford; W/O. L. A. Foster; F/O. K. B. Hadley; F/O. D. J. Jackson; Sgt. G. D. Lees; F/O. G. F. Maffre; Flt. Sgt. R. A. Meek; F/O. W. Murphy; Sgt. J. Rutzki; Flt. Lt. G. J. Smith; Flt. Lt. S. J. R. Soper; Flt. Sgt. D. Tomlin; Flt. Lt. A. J. Watson; F/O. D. D. Watterson; W/O. E. V. Webb; Sgt. J. Whittaker.

MISSING.—F/O. E. O. Aaron; Flt. Lt. L. A. Allen; Sgt. R. H. Banks; W/O. A. J. G. Barnes; Sqn. Ldr. C. K. Barrett; Sqn. Ldr. E. W. Blenkinsop, D.F.C.; F/O. J. A. C. Brown; Sgt. R. C. Brown; Flt Sgt K. L. Cannings; W/O. J. R. Chapman; W/O. A. A. Cormier; Flt. Sgt. V. J. Cownden; Flt. Sgt. G. J. Cronk; Sgt. R. N. Cunningham; F/O. D. A. D'Andrea; P/O. T. W. Dowbiggin; Flt. Sgt. S. F. Ellis; P/O. T. W. Fair; F/O. L. M. Falkins; F/O. J. Feldman; F/O. A. R. Girolami; P/O. T. A. Goundrey; Sgt. J. V. J. Gravel; W/O. W. D. Hall; P/O. A. Hamilton; F/O. S. A. Hawkins; Sgt. G. W. Heming; Flt. Sgt. A. G. Holke; Flt. Lt. G. W. Knupp; Sgt. C. B. Lamb; Flt. Sgt. A. J. Leach; W/O. J. W. R. Lefebvre; F/O. N. A. Loranger; W/O. J. R. McConnel; W/O. G. McDougall; W/O. N. A. F. MacKenzie; F/O. R. McLeod; F/O. D. M. Margison; F/O. T. R. Martin; Flt. Lt R. F. Mead; P/O. A. J. Muir; Flt. Sgt. J. A. B. Ouimet; F/O. L. Panzer; F/O. W. H. Parkinson; Flt. Lt. D. H. Perry; Flt. Lt. D. Ramsay, D.F.C.; F/O. A. S. Redmonds; W/O. J. C. Roach; P/O. H. K. Rose; Sgt. W. M. Ross; W/O. C. H. Shaw; F/O. S. G. C. Sherman; Sgt. G. E. Sinclair; W/O. C. W. Smith; Sgt. J. E. Smythe; W/O. G. W. Snow; F/O. A. G. P. Stacey; Sgt. R. F. Stubelt; P/O. C. M. Sylvah; F/O. C. K. Thain; Sgt. J. S. Thomson; P/O. D. W. L. Vander; F/O. L. C. E. Webley; F/O. G. K. Willis.

SERVICE AVIATION

WOUNDED OR INJURED ON ACTIVE SERVICE.—W/O. S. T. Bennett; W/O. S. D. Oakes.
DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. A. O. Wedin.

Royal New Zealand Air Force

MISSING, BELIEVED KILLED IN ACTION.—P/O. W. E. Kewley.
MISSING.—Flt. Sgt. J. H. Barton; P/O. C. R. Marriott, D.F.M.; Act. Flt. Lt. C. F. Penfold; Flt. Lt. J. B. Smith, D.F.C.
MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—W/O. E. S. Chegwidden; Flt. Lt. T. Hinde.

South African Air Force

MISSING.—2/Lt. D. P. McGee; Lt. J. G. Schuurman.

Casualty Communique No. 417

Of the names in this list, 104 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Flt. Sgt. R. E. Barnes; Sgt. C. D. Russell.
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. W. R. Bray; Sgt. H. Exley; Sgt. D. W. Hall; Sgt. A. S. Haxton; P/O. W. F. C. Knight; Sgt. W. L. Morpeth; Sgt. A. C. Petre; F/O. S. J. H. Verney.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. W. J. Batty; Sgt. D. W. Burdett; Sgt. A. Carter; P/O. G. H. Clarke; P/O. E. J. Cook; Sgt. W. A. Crawford; Sgt. G. R. Cutter; Sgt. J. O. Davies; Sgt. F. Earnshaw; Flt. Sgt. A. E. Evans; Flt. Sgt. R. G. Finlay; Flt. Sgt. M. J. T. Finn; F/O. N. J. Fletcher; Sqn. Ldr. G. K. F. Garrad; Sgt. B. R. Giles; Sgt. D. Grout; Sgt. J. Hardy; Sgt. C. Harrison; Sgt. F. A. Jones; Flt. Lt. A. G. MacLeod, D.F.C.; Flt. Sgt. H. Maitland; Sqn. Ldr. R. J. Manton; P/O. W. T. Mathison; Sgt. K. E. Moulding; Sgt. A. Phethean; P/O. P. G. Quayle; F/O. I. J. Roberts; Sgt. C. Rodham; Sgt. R. Thornton; Sgt. G. Vardy; Sgt. F. P. Wilby; F/O. F. Williams; Act. Flt. Lt. L. K. Williams; F/O. S. H. A. Woodhouse.
WOUNDED OR INJURED IN ACTION.—F/O. T. Knowles; Sqn. Ldr. D. McN. Livingstone, F/O. J. D. McCarthy; Sgt. K. M. Pincott; Sgt. R. Wilson.
MISSING, BELIEVED KILLED IN ACTION.—Sgt. W. A. Baker; Flt. Sgt. G. Carter; Sgt. J. F. Clements; Flt. Lt. M. I. Cox, A.F.C.; Sgt. J. Dorrity; Act. Sqn. Ldr. P. W. Dunn; Flt. Lt. J. A. T. Meredith, D.F.C.; F/O. F. G. Raine; F/O. T. Rickland; Flt. Lt. S. A. Rodgers; Flt. Sgt. C. D. Towse, D.F.M.; Sgt. J. A. Warburton; F/O. R. A. Watson; F/O. W. V. Whittaker; Sgt. J. Wilson; W/O. A. Witham.
MISSING.—Sgt. T. Alldritt; Sgt. E. Anthony; P/O. S. S. Atkin; Sgt. H. Blackett; P/O. R. J. Blake; Sgt. J. V. Bramhall; Sgt. D. M. Brandrick; Sgt. E. R. Bray; Sgt. R. F. Burgum; Sgt. L. J. Carey; Flt. Lt. J. O. Carpenter; Sgt. R. C. Carvell; P/O. J. S. MacL. Clarke; Sgt. P. Clark; Flt. Sgt. E. C. Coldicutt; Sgt. R. F. Collier; Flt. Sgt. T. A. Colman; P/O. G. H. Congreve; F/O. E. J. Cooper; Act. Sqn. Ldr. J. M. Dennis, D.F.C.; Flt. Sgt. B. Fraser; P/O. G. G. M. Gage; Sgt. D. Gemmell; Flt. Sgt. R. F. A. Giles; Sgt. R. D. Gould; F/O. J. V. Hayward; Flt. Sgt. F. W. A. Head; Flt. Lt. R. J. Hewett, D.F.M.; P/O. L. W. Higgins; Sgt. W. Houghton; Sgt. E. F. Hudson; Sgt. W. A. Hughes; Act. W/O. R. T. Hunt; P/O. A. E. Jackson; F/O. R. Jacques; Sgt. E. Jones; Sgt. W. B. Kinder; Sgt. P. J. J. Kofoed; Sgt. R. B. Laroche; Flt. Sgt. J. Law; Flt. Sgt. A. G. Lawrence; P/O. I. F. H. McKenna; Flt. Sgt. R. MacQuaker; Sgt. R. Maddison; Flt. Sgt. D. Marriott; P/O. K. G. Marris; P/O. K. R. Mather; Sgt. A. J. Mitchell; Sgt. H. L. Molyneux; F/O. J. W. Oakley; Sgt. E. Oldroyd; Flt. Sgt. J. H. P. O'Neill; Flt. Sgt. A. Pearson; Flt. Lt. H. H. Percy; Sgt. A. C. Phillips; Sgt. I. C. Plumb; W/O. C. G. Polkey; Sgt. J. Rafferty; Sgt. A. B. Randall; Sgt. W. L. A. Restell; Sgt. P. W. Richards; Sgt. D. B. Robertson; Flt. Sgt. J. H. Ross; Sgt. R. B. Russell; F/O. C. Sacker; Flt. Sgt. E. Shepherd; Act. Flt. Lt. A. L. Silverman; Sgt. L. R. D. Somers; Flt. Sgt. W. Taylor; Sgt. L. Timmins; Sgt. R. F. Toland; Sgt. R. Wallace; Sgt. K. N. Ward; Sgt. L. F. Webb; Sgt. A. White; Sgt. S. White; Flt. Lt. G. W. Williams.
MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Flt. Sgt. F. O. Kirsopp; A/C.1 R. Shoesmith; Flt. Sgt. D. F. H. Taylor.
KILLED ON ACTIVE SERVICE.—Sgt. N. Bingham; Cpl. J. T. Bootland; F/O. G. H. Bowen; Flt. Lt. A. E. H. Cattle; Sgt. C. R. Coe; Sgt. K. Foster; Flt. Sgt. C. F. Gardiner; A/C.2 W. Grisenthwaite; F/O. G. G. Halestrap, D.F.C.; Sgt. P. A. Harrison; Flt. Sgt. A. P. Hebbes; Sgt. A. A. J. Higgins; Sgt. W. Hoffe; Flt. Lt. S. C. Holbrow; A/C.2 G. R. Kemp; Flt. Lt. W. Kenny; L.A/C. A. E. King; Act. Flt. Lt. R. B. Levack; F/O. K. B. Leaver; A/C.1 J. MacKinnon; Flt. Sgt. T. Murray; F/O. G. M. Rea; A/C.2 J. G. Robinson; F/O. G. L. Storey; F/O. F. Walsh; Sgt. C. F. West.
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. R. A. Mushet.
PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED ON ACTIVE SERVICE.—Act. Wing Cdr. D. N. Milligan, D.F.C.
WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Lt. P. C. Gee; Flt. Sgt. J. L. Williams.
DIED ON ACTIVE SERVICE.—Act. Cpl. C. G. Baker; A/C.1 B. Berryman; Sgt. D. L. Coleman; Act. Cpl. C. J. Coulman; Sgt. W. E. Dann; L.A/C. W. J. A. Davis; Sgt. B. B. M. Finnigan; L.A/C. G. W. F. Hart; Sgt. R. E. Herbert; L.A/C. R. Hodgkinson; A/C.2 W. Mair; L.A/C. G. P. Mountford; Cpl. J. O'Neill; Cpl. N. Partridge; L.A/C. W. Settle; L.A/C. A. Stealey; A/C.2 E. Turner.
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED PRISONER OF WAR.—F/O. G. W. Kelly.
PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. L. J. Barnes; P/O. A. W. Dean; Flt. Sgt. E. Render; Flt. Sgt. C. B. Rowlston.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—L.A/CW. D. F. J. Bailey; A/CW.1 A. Dickson.

Royal Australian Air Force

KILLED IN ACTION.—F/O. H. T. Ward.
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. R. T. McCudden; Flt. Sgt. R. J. Rays.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. M. G. Barrett-Lennard; Flt. Sgt. N. W. Buchanan; Flt. Sgt. D. V. Cox; Sgt. J. E. Duff; Flt. Sgt. R. A. Ellis; Flt. Sgt. H. C. Fleley; P/O. R. G. Fisher; P/O. P. M. Goldsmith; Flt. Sgt. R. H. Hansen; F/O. J. W. Leitch, D.F.C.; Flt. Sgt. D. M. MacPherson; P/O. C. M. Nairn; Flt. Sgt. G. F. Ritchie; F/O. L. W. Roper; Flt. Sgt. A. N. F. Rushton; Flt. Sgt. D. H. Smith; Flt. Sgt. W. R. Walters; Sgt. G. W. Ward.
MISSING, BELIEVED KILLED IN ACTION.—P/O. J. S. Woodhams.
MISSING.—W/O. N. O. Bowden; Act. Flt. Lt. R. McK. Croft; F/O. D. P. Croston; P/O. R. W. Jones; P/O. L. E. Mehden; Act. Sqn. Ldr. M. Powell, D.F.C.; Flt. Lt. W. N. Read; P/O. S. R. Stead; F/O. N. O. Thomas; W/O. J. E. Williamson.
KILLED ON ACTIVE SERVICE.—W/O. H. Milne.
DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—P/O. J. B. Fleming.

Royal Canadian Air Force

KILLED IN ACTION.—F/O. G. A. England; Flt. Lt. F. R. McGugan.
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. R. G. Christie; F/O. R. Christie; P/O. G. L. Hughes; F/O. S. McManus; Flt. Sgt. B. D. Winders.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. B. A. Anderson; P/O. S. K. Atkinson; Flt. Sgt. J. G. M. Aubin; Flt. Sgt. M. Bailey; F/O. R. E. Baker; F/O. W. G. R. Baum, F/O. R. W. Burke; Flt. Sgt. J. Clark; F/O. E. M. Cole; F/O. R. C. Day; F/O. W. N. Hamilton; Sgt. J. P. Heinig; Flt. Sgt. I. D. Jennings; Flt. Sgt. J. A. Leach; Flt. Sgt. R. Lesser; Flt. Sgt. M. L. McClay; Flt. Sgt. S. C. MacLennan; Flt. Sgt. H. C. MacMillan; Sgt. W. Ness; Flt. Sgt. J. S. Silver; W/O. G. G. Sveinson; Flt. Sgt. G. W. Thompson; Flt. Sgt. A. F. Todd; Flt. Sgt. J. R. Trace; Sgt. R. N. Wallace; Flt. Sgt. G. S. Walter.
MISSING, BELIEVED KILLED IN ACTION.—F/O. R. E. Banks; Flt. Sgt. D. J. Copeland; F/O. W. R. Ellwood; F/O. H. E. Dougherty; P/O. D. A. Pastorius; F/O. W. H. Pedlar; F/O. R. N. Peever; F/O. W. A. Porterfield; P/O. J. Smith; W/O. D. W. Vaughan.
MISSING.—W/O. T. R. Bradshaw; Flt. Sgt. H. A. A. Breeze; W/O. J. D. Bremner; F/O. J. W. Burrows; F/O. R. S. Campsall; W/O. A. M. Casey; W/O. R. Chaplin; W/O. W. T. Claridge; F/O. A. S. Coldridge; P/O. A. C. Donnell; Flt. Sgt. K. J. Doyle; P/O. P. E. Driver; Flt. Sgt. E. R. Dujay; W/O. L. F. Dutton; F/O. R. C. Evans; F/O. T. R. Forsyth; W/O. J. Gilson; W/O. S. H. Goulding; Sgt. G. T. Greig; Flt. Sgt. G. Q. Hansen; Flt. Sgt. C. H. Havill; Flt. Lt. J. M. Hill; P/O. A. L. Horton; F/O. G. J. Huddart; Sgt. H. E. Isles; F/O. D. A. Lennie; P/O. J. L. Leyne; F/O. D. H. Loewen; W/O. G. A. Lorimer; W/O. J. R. McClelland; F/O. D. A. McCoy; P/O. D. McDonald; P/O. R. A. McIvor; F/O. H. D. Medland; P/O. J. B. Millar; P/O. J. B. Morison; P/O. V. Mudford; P/O. L. A. Nethery; Sgt. E. E. F. Park; W/O. R. W. Pratt; W/O. N. L. Reid; Sgt. S. J. Rigden; F/O. C. A. Rooks; W/O. K. L. Schmidt; F/O. K. T. Schubert; Flt. Sgt. G. E. H. Schultz; Flt. Sgt. R. J. Smith; F/O. J. Stoyko; Flt. Sgt. K. D. Tucker; P/O. E. A. Vigor; F/O. H. H. Whaley; Sgt. J. Wilson; F/O. W. H. Wilson; F/O. A. E. Young.
KILLED ON ACTIVE SERVICE.—Sgt. K. P. Campbell; Flt. Sgt. J. Davis; Sgt. W. H. England; F/O. J. A. Gillies; Sgt. A. W. Huppe; Sgt. J. P. Leech; Flt. Lt. M. McIver, D.F.C.; Sgt. F. G. Murray; Sgt. D. Pickering; Sgt. R. W. Smith; Cpl. L. R. Wilcox; Sgt. J. M. Wolowiec.
PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—P/O. E. D. Nesbitt.

Royal New Zealand Air Force

KILLED IN ACTION.—F/O. C. C. McCormack.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. J. B. Lovelock.
WOUNDED OR INJURED IN ACTION.—F/O. R. H. Thorburn.
MISSING.—P/O. J. A. S. Wright.
PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Act. Flt. Lt. A. Muggeridge; W/O. M. D. Smith.

South African Air Force

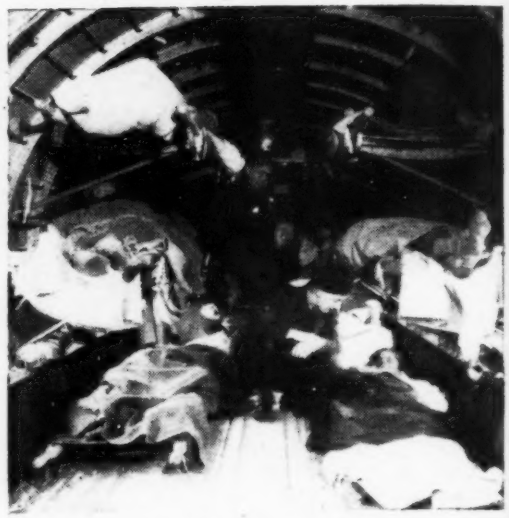
DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—W/O. V. M. Tedder.
MISSING, BELIEVED KILLED IN ACTION.—2/Lt. R. W. Rowan.
MISSING.—W/O. P. Detoit; Lt. W. O. Joubert; 2/Lt. G. Mervis.
KILLED ON ACTIVE SERVICE.—Lt. A. B. Barter.
DIED ON ACTIVE SERVICE.—Air Mech. A. A. Etsebeth.

Indian Air Force

MISSING, BELIEVED KILLED IN ACTION.—Sgt. A. M. Khan.

Air Transport Auxiliary

Capt. FRANK ASHTON WHITE, A.T.A., killed whilst ferrying His Majesty's aircraft in England.
First Officer JOHN LUDLOW GLOVER, A.T.A., killed whilst ferrying His Majesty's aircraft in Scotland.



BLIGHTY EXPRESS: The interior of a Douglas D.C.3 with its complement of wounded men ready for the flight back to England. This Dakota is manned by R.A.F. medical orderlies.